FAA SE-2020 SIR2FO
Contract: DTFAWA-10-D-00030
Task Order: 0031 Flight Object
CDRL #: 30_0031_CDRL_1287_0006_20120315

Flight Object System Requirements

Document v2 - FINAL

Submitted by:

Booz | Allen | Hamilton

8255 Greensboro Drive
McLean, VA 22102

Date: 9 March 2012

Federal Aviation Administration

Flight Object System Requirements

9 March 2012

Developed by:
Booz Allen Hamilton

Table of Contents

1. Introduction

This document provides high level System Requirements for Flight Object (FO) in the NextGen environment. The requirements address both the long term steady state FO functionality (the primary focus of this document) and the activities needed to achieve an initial FO capability.

1.1. Long Term - Steady State FO Requirements

These requirements address the long term steady state capabilities needed to achieve the full envisioned Flight Object functionality in the operational NextGen environment. They address the flight data and the exchange of flight data among authorized Air Traffic Management (ATM) participants.

The “Global Air Traffic Management Operational Concept” (ICAO 9854) and the “Flight and Flow Information for a Collaborative Environment” (FF-ICE) concept document are the primary sources for these system requirements. Additional sources include the Flight Object Requirements Flight Object Exchange System (FOXS) Engineering Needs Document (September 2011) and the Flight Object Concept of USE (FO CONOPS). Each requirement is linked to guidance in one or more of the four source documents. Appendix A provides the specific guidance basis and underpinning for each long term steady state requirement (Shall) statement.

These FO long term steady state requirements are grouped and organized according to 11 “needs” areas that are listed below and discussed in the Flight Object Requirements Flight Object Exchange System (FOXS) Engineering Needs Document. An overview of the requirements grouped under each needs area and the requirements (shall statements) that fall within them are provided in the second section of this document.

1. Accurate and Complete Flight Data
2. Flight Data Management
3. Flight Data Exchange Management
4. Discovery of Current and Evolving Future Requirements
5. Support for Cross-Regional International Flight Data Content and Data Exchange Requirements

6. Flight Data Exchange Security
7. Flight Data and Data Exchange Governance
8. System Engineering Products
9. Flight Data Content and Data Exchanges Performance
10. Data Exchange Software Engineering
11. Data Exchange System and Network Management

1.2. Initial FO Capability Requirements

The FO initial Flight Object capability requirements attempt to specify the capabilities needed to achieve an initial FO capability in a timely fashion. These requirements are consistent with, and loosely linked to, several ongoing NAS efforts being pursued in parallel to the systems requirements development efforts. The ongoing parallel efforts are developing specific implementation plans, capabilities, approaches and analyses.

These requirements are drawn from the following efforts and sources:

- FO data dictionary (FODD)
- Implementation Plans for an initial FO capability
- Flight Information Exchange Model (FIXM) plans (see www.fixm.aero)
- FO Engineering Analysis
- Flight Object Exchange System (FOXS)

In addition the initial capabilities requirements consider the following international efforts and documents being addressed under the FIXM development efforts.

- ICAO 2012 Flight Plan
- ED-133

A key assumption for this set of requirements is that the SWIM capability will exist when the initial FO capability is implemented.

The FO Transition and Implementation Requirements are grouped under the following four categories:

1. FO Plans, Models and Analyses
2. FO Data Definitions and Requirements
3. FO Management
4. FO Data Exchange Services

2. 1.1. Long Term - Steady State FO System Requirements

2.1. Accurate and Complete Flight Data

This category focuses on defining and establishing Flight Object data element content, traceability, authorizations, preferences, priorities, constraints, and access rights. The requirements also address the need for valid, unambiguous and generally usable data elements.

The primary focus (requirement 2.1.1) is to define data elements that support the Concept Components and the Flight Life Cycle Phases detailed in ICAO 9854 and FF-ICE. While, by design, the 'shall' statements in this section are at a high level, Appendix B provides data element-specific guidance and suggestions from ICAO 9854 and FF-ICE that should be considered when addressing this requirement.

The requirements in this area are:

1.1.1. FO shall include all data elements needed to support the ATM Concept Components and Flight Life Cycle functionality detailed in ICAO 9854 and FF-ICE and summarized in the Flight Object Engineering Needs document.

1.1.2. FO shall include ownership, update authorization, retention period, subscription and access privileges for every FO data element and data service.

1.1.3. FO data shall include Airspace User preferences, permissions, priority, aircraft capabilities, performance, and constraints.

1.1.4. FO shall generate standardized valid, unambiguous, consistent and usable data elements.

1.1.5. FO data and services shall enable and support airspace users provision of enhanced early intent flight information

1.1.6. FO data and services shall enable and support 4D Trajectory planning and management for flights.

2.2. Flight Data Management

This category focuses on defining and establishing the process and methods with which Flight Object data is gathered and verified. The requirements emphasize the need to develop data elements that are software-interoperable and operationally relevant.

The requirements in this area are:

1.1.7. FO shall establish processes, which efficiently, effectively, and accurately gather and correlate data, in support of NextGen ATM-related operations.

1.1.8. FO shall develop, support, and enable global processes that refine and validate the data, meta-data, and automation in accordance with the Global ATM Operational Concept (ICAO 9854).

1.1.9. FO shall develop optimal, flexible, machine-readable information to ensure appropriate automation.

1.1.10. FO shall develop and maintain an operationally agnostic data model representation of the information within the flight domain.

1.1.11. FO shall define and regulate the chronological sequence of flight data input, updates and sharing in support of automated flight management and execution.

2.3. Flight Data Exchange Management

Under NextGen, there will be significant increases in the amount of data shared, the number of participants sharing data, and systems facilitating data exchanges. The requirements highlight flight data exchange requirements that will enable timely and larger-scale data sharing and enhanced Collaborative Decision Making in the NextGen operational environment.

The requirements in this area are:

1.1.12. FO shall provide the ability to share relevant and timely flight information across a broad range of authorized ATM participants throughout the life cycle of a flight.

1.1.13. FO shall enable and support a higher level of collaboration and automated CDM than was available prior to NextGen implementation.

1.1.14. FO shall enable and support a globally consistent mechanism and interface for providing and receiving flight information.

1.1.15. FO shall be designed to operate within SWIM.

1.1.16. FO shall provide a mechanism (or mechanisms) to exchange defined proprietary data, flight preference data, performance data, and FO information updates among authorized users.

1.1.17. FO shall ensure that air defense systems, military control systems, SAR organizations, accident/incident investigation authorities, law enforcement,

and regulatory authorities receive the needed timely and accurate information on flights and ATM system intents.

1.1.18. FO data exchange shall enhance flight data interoperability and accessibility.

1.1.19. FO shall enable authorized users to personalize and filter their flight data exchanges in support of their efforts to access only the flight data they need.

2.4. Discovery of Current and Evolving Future Requirements

This category addresses Flight Object data and data exchange discovery- related topics. Some of the requirements address identifying and making available information on the FO data and data exchanges that are required from different ATM participants in different situations and during the different phases of the flight life cycle. Other requirements address identifying the data that is available to the ATM participants (primarily Airspace Users) and providing mechanisms to provide this information. Finally, the requirements address the need for mechanisms by which all ATM participants can become involved in establishing new data and data exchanges.

The requirements in this area are:

1.1.20. FO shall identify and make available flight data and data exchange requirements.

1.1.21. FO shall identify the flight data and data exchange services that are available to and/or are required from Airspace Users and provide mechanisms to make this descriptive information available.

1.1.22. FO shall provide mechanisms by which all ATM participants can participate in identifying and developing new flight data and data exchanges as members of the CDM process.

2.5. Support for Cross-Regional International Flight Data Content and Data Exchange Requirements

This section addresses the need to simultaneously support multiple sets of data and data exchange requirements. There are two primary reasons for this set of requirements. First there are differences in the data and data exchange requirements among the regions that must be addressed and supported. Second, during the transition to NextGen, entities will independently move from legacy to NextGen functionality and processes.

The requirements in this area are:

1.1.23. FO shall identify and support region-unique and region-to-region flight data and data interface requirements.

1.1.24. FO shall support the transition and evolution of the flight plan and flight-related messages.

1.1.25. FO shall support ATM operations during the transitional period during which ATM participants independently transition to full NextGen functionality.

1.1.26. FO shall exploit and make best use of the NextGen functionality implemented at each transitional step.

2.6. Flight Data Exchange Security

This category focuses on defining and establishing the security method for Flight Object. The requirements emphasize the need to maintain a ‘defense-in-depth’ security strategy while minimizing any functional impact on the interoperability of the system.

The requirements in this area are:

1.1.27. FO shall identify and provide flight data and data exchange security in the multi-tiered heterogeneous operational ATM environment.

2.7. Flight Data and Data Exchange Governance

This category focuses on defining and guiding the governance processes by which the Flight Object will be managed. The requirements highlight the need to clearly articulate stakeholders and objectives, while delivering reliable and consistent communications.

The requirements in this area are:

1.1.28. FO governance functions shall define and enable globally consistent standards-based flight data and data exchange mechanisms.

1.1.29. FO shall develop and maintain appropriate management, secretariat facilitation support, and processes during the evolution to full NextGen functionality.

2.8. System Engineering Products

This category addresses the supporting materials needed to implement the planned Flight Object functionality. The requirements emphasize the need to document appropriate system engineering support information and to maintain an evolutionary development of that documentation in support of the evolution of Flight Object.

The requirements in this area are:

1.1.30. FO shall devise, document and support development of appropriate touch-points and interactions with the aeronautical and other NextGen domains.

1.1.31. FO data shall be linked to and compatible with the NAS Enterprise Architecture.

1.1.32. FO shall ensure that flight data and data interfaces address and support safety considerations.

1.1.33. FO shall enhance the consistent, effective, and efficient use of flight data and data interfaces.

2.9. Flight Data Content and Data Exchanges Performance

This category covers engineering needs for NextGen flight data content and exchange performance improvements. The move to trajectory based operations, where individual flights have multiple options within their desired flight plan that are initiated or amended based on National Airspace System (NAS) performance, will require improved NAS data handling capabilities. The need for common situational awareness and performance data will also drive requirements for improved data availability and quality of service. As flight crews, aircraft operators, and ATM service providers collaborate on movements within the NAS, they must be assured they have common data that is accurate and efficiently available.

The requirements in this area are:

1.1.34. FO shall ensure that flight data is exchanged within the required timeliness needed to support ATM operations and participants' requirements.

1.1.35. FO shall identify and support efforts to define, regularly review, and monitor performance for individual flights and the ATM system.

1.1.36. FO shall provide mechanisms for flight data exchange that enables support of the defined and agreed to quality of service (to include data-associated security, latency, risk management, and reliability).

1.1.37. FO shall enable and support desired ATM system adaptability and scalability levels.

1.1.38. FO shall ensure that required flight information is available for all phases of the flight life cycle.

1.1.39. FO shall identify, enable, and support efforts to monitor and ensure flight data quality and data integrity.

1.1.40. FO shall identify, enable, and support efforts to monitor and ensure data reliability and compliance with flight data requirements.

2.10. Data Exchange Software Engineering

This category addresses the need for software engineering to ensure commonality in data management and harmonization of NextGen data elements. FO software must be robust and must ease parsing and display of information.

The requirements in this area are:

1.1.41. FO shall provide and support robust applications to ease parsing and display of pertinent information.

1.1.42. FO shall support and promote use of standardized and open source software tools.

2.11. Data Exchange System and Network Management

Movement to NextGen capabilities requires the use of standards and network management to help address critical global ATM system-wide considerations. The Flight Object needs to enable not only wider sharing of increased amounts of flight information, but also delivery assurance for this information. In addition, the requirements address the need for FO services to interact with ATM participants at different points along the flight information timeline, including maintenance and provision of archived data.

The requirements in this area are:

1.1.43. FO shall enable and support an end-to-end flight data delivery assurance scheme for SWIM region-to-region and ATM participant-to-ATM participant interfaces.

1.1.44. FO shall identify, enable and support the establishment and sharing of the archived flight data needed for trend analysis, validation, forecasting, and modeling.

1.1.45. FO shall provide or support mechanisms that enable increased flight data sharing among the different authorized ATM participants for each flight life cycle phase.

1.1.46. FO shall enable and support system resilience to service disruption and its associated temporary loss of capacity.

3. Initial FO Capability Requirements

3.1. FO Plans, Models and Analyses

The initial FO capability requirements in this section collectively address the need to:

- Describe the overall planned capability
- Specify the scope of the capability
- Identify the data sources
- Describe the FIXM and FOXS functionalities
- Set the technology underpinning or foundation needed to enable and achieve the capability
- Specify the time-phased plan and approach for establishing the capability
- Identify the areas where governance is required and the means envisioned to for provide it

Included in this area is the need for initial FO capability conceptual plans, descriptions, architectures, and implementation strategies/plans.

1.1.47. FAA shall develop an implementation plan to establish an initial FO capability that addresses all the topics covered in these requirements.

1.1.48. FAA shall establish a Flight Information Exchange Model (FIXM) which will include items such as a data dictionary, logical model, and XML Schema.

1.1.49. FAA shall identify the shortfalls addressed by implementing an initial and full set of FO capabilities.

1.1.50. FAA shall identify the new and/or improved functionality associated with the implementation of the initial FO capabilities.

1.1.51. FAA shall identify the benefits associated with implementing an initial and full set of FO capabilities.

1.1.52. FAA shall identify the services required to implement the initial FO capability.

1.1.53. FAA shall describe the desired FOXS functionality and identify the services planned for the initial FO capability.

1.1.54. FAA shall define the overall system architecture for FO data exchange services for the initial FO capability.

1.1.55. FAA shall identify the areas that require governance and the means planned to provide it.

3.2. Data Definition and Use

The requirements in this area address the actual FO data elements, their required attributes, and their legacy source systems. They also address the need to identify and characterize the consumers of the flight data, their permissions and the access they will be authorized to receive. Finally the requirements call out the need for the actual FO data models and schemas.

1.1.56. FAA shall specify the list of data elements to be included in the initial FO (FIXM) data set to include those from the ICAO 2012 Flight Plan and other international sources.

1.1.57. FAA shall specify the meta data, and attributes, for each FO data element and document them.

1.1.58. FAA shall specify the legacy systems that will be the data sources for the initial FIXM data set, to include those providing the internal-based data elements.

1.1.59. FAA shall specify the single legacy data system source for each FO data element.

1.1.60. FAA shall specify the set of authorized users and their permissions

1.1.61. FAA shall specify and use a Globally Unique Flight Identifier (GUFI) to identify flights.

1.1.62. FAA shall specify or categorize the types of FO data consumers.

1.1.63. FAA shall establish data access controls for each FO data element and type of supported data consumer.

3.3. FO Capability Management

The requirements in this area focus on the establishment of the needed management structures. Most the requirements deal with governance but other topics such as the need for both data and data exchange security and the ability to recover lost data are also addressed.

1.1.64. FAA shall ensure that all FO data and data exchange services are SWIM-compliant.

1.1.65. FAA shall establish the FO governance body or bodies and specify the scope of the governance activities.

1.1.66. FAA shall establish SWIM-compliant governance rules and policies to reconcile and resolve data validity errors.

1.1.67. FAA shall establish governance rules, criteria and policies that address data publishing, access, and reception rules for both government and commercial NAS users.

1.1.68. FAA shall insure appropriate security for the FO data and data exchange services.

1.1.69. FAA shall establish discovery mechanisms by which authorized NAS users can identify the available FO data and data exchange services.

1.1.70. FAA shall establish mechanisms by which system users can participate in the identification of additional services and FIXM data holdings.

1.1.71. FAA shall document the conversion and validation rules used to convert legacy source data to FO data.

3.4. Data Exchange Services

The requirements in this area address the establishment actual FO data exchange services. Included are both the services needed to convert legacy data to the FO formats and those needed to provide the data to the FO data consumers. Data transfer mechanisms and lost data recreation or reconstitution are also addressed.

1.1.72. FAA shall establish a SWIM-based FO data connections/feeds from the specified legacy system source for each FO data element.

1.1.73. FAA shall establish mechanisms to accept the FO data source data generated by the legacy source systems for the data element.

1.1.74. FAA shall establish mechanisms to convert the legacy source data, for each FO data element, to the FO (FIXM) format.

1.1.75. FAA shall establish mechanisms to validate data received from each FO source system for data errors and data consistency.

1.1.76. FAA shall establish mechanisms by which authorized FO users can request FO data and/or data feeds.

1.1.77. FAA shall establish mechanisms to provide FO data in FIXM-defined formats to authorized users.

1.1.78. FAA shall establish FO data exchange services that enable authorized external users to submit FO data to the FAA.

1.1.79. FAA shall establish FO data exchange services that enable the exchange of FO data with international ANSPs.

1.1.80. FAA shall establish a mechanism by which missed FO data can be recreated or reconstituted.

1.1.81. FAA shall establish SWIM-compliant FO data exchange that support both streaming and request/reply FO data delivery services.

Appendix A

This appendix provides the specific guidance basis and underpinning for each of the long term, steady state requirement (Shall) statements in turn. The guidance citations are from the three Flight Object requirements source documents (the "Global Air Traffic Management Operational Concept", ICAO 9854 [9854], the "Flight and Flow Information for a Collaborative Environment" [FF-ICE] concept document and the "The FAA Flight Object Engineering Needs", September 2011 [Eng Needs]).

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.1			**FO shall include all data elements needed to support the ATM Concept Components and Flight Life Cycle functionality detailed in ICAO 9854 and FF-ICE and summarized in the Flight Object Engineering Needs document.**
1.1	FF-ICE	2 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.
1.1	FF-ICE	2.2 Sharing Flight Information	The FF-ICE will replace all existing data message formats between ATM Community members about flight intent and flight progression.
1.1	FF-ICE	2.2 Sharing Flight Information	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
1.1	FF-ICE	2.2 Advance Notification	The airspace user will be able to notify flight intent up to a year in advance. Details will be able to be progressively supplied (as information becomes reliable enough to communicate).
1.1	FF-ICE	2.2 Inconsistent Flight Information	On the first notification of flight intent, a globally unique flight identifier (GUFI) will be created that will allow all (with appropriate access rights) to view or modify information related to the same flight.
1.1	FF-ICE	2.3 – R09	Use relevant data to dynamically optimize 4D trajectory planning and operation
1.1	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
1.1	FF-ICE	2.3 – R62	Select the applicable separation modes and separation minima for CM that best meet the ATM System performance targets

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.1	FF-ICE	3.1 Principles	Allow aircraft to indicate their detailed performance capabilities, such as required navigation performance (RNP) level.
1.1	FF-ICE	3.1 Principles	Allow for an early indication of intent.
1.1	FF-ICE	3.1 Principles	Support 4D management by trajectory.
1.1	FF-ICE	3.3 Overall Collaborative Environment	In addition, not all information elements are required for all flights depending on desired performance levels.
1.1	FF-ICE	3.3.1 Elts of the ICE	For performance reasons, different information elements will be required under different circumstances, locations, and times. The required set of information elements and conditions on providing information will be specified in requirements. Both global and regional requirements will exist. . As an example, one region may require airport slot information for coordinated airports at some time before estimated off block time (EOBT). A mechanism will be in place to ensure, through automated means, that information requirements are complied with. Compliance with requirements may be real-time (e.g., information item is provided by a specified time) or post-analysis (e.g., early intent information meets accuracy requirements).
1.1	FF-ICE	3.3.1 Elts of the ICE	AUO will face requirements on performance and/or approved capabilities, both static and dynamic. Some of these requirements are expected to be linked to aeronautical information. For example, certain airspace volumes or routes (where defined) will require levels of navigation performance. A mechanism must exist to specify and disseminate these requirements. These requirements may also be altered as a result of AOM activities or weather conditions.
1.1	FF-ICE	3.3.1 Elts of the ICE	Separation provision activities will be conducted by the designated separator, which may be an ASP or the airspace user. In a trajectory-based environment, this activity operates on the 4D trajectory supplied as part of flight information, supplemented with up-to-date surveillance information. Separation provision must also consider the overall ATM situation, including dynamical aeronautical information, weather, and infrastructure status as shown in Figure 3.3-5.
1.1	FF-ICE	3.4 FF-ICE Timeline	Whereas currently an aircraft operator may file a single FPL form, in the future, the operator will provide increasing information about a flight as time approaches departure and throughout the flight. Some of this information is known ahead of time with relative certainty (e.g., departure and arrival airport), other information will be better known closer to departure (e.g., route of flight, estimated time en-route), and some could change dynamically throughout the flight (e.g., estimated time of departure, agreed trajectory).
1.1	FF-ICE	3.4 FF-ICE Timeline	Since the flight information process is expected to be ongoing, requirements for the provision of information will be event-driven. These can include certain events such as: the availability of a significant piece of data such as weather, a fixed time before scheduled pushback, a time prior to entry into airspace, the issuance of a clearance, or a change in responsibility. One example of an information provision requirement would be that before departure, the airspace user shall supply information necessary for the provision of emergency services.
1.1	FF-ICE	3.4 FF-ICE Timeline	Initial information provision may occur at any point along the timeline. For example, differing airspace users may have different planning horizons as described in Section 3.4.5. This initial information will be provided through a designated point-of-entry (POE, see Appendix H.1.5) and to an ASP typically applicable to the flight's departure point. Some ASPs may accommodate multiple POEs, and some ASPs may accommodate the receipt of initial flight information from POEs not explicitly associated with a flight's departure point. Clarity regarding responsibility for information is aided by information audit trails.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace user-provided information is subject to change as information becomes known with greater certainty closer to departure. Operators providing this information are expected to update it as more accurate planning information becomes available.
1.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Flight information will be updated by referencing a global common identifier for a flight.
1.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace users may wish to provide information for flights which will operate in the same manner on a repeated basis. This is acceptable
1.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Nothing precludes an operator from supplying more information at an earlier point in the timeline.
1.1	FF-ICE	3.5.1 Scheduling and Strategic Activities	In a performance-based environment, certain regions will require more stringent information provision in order to achieve required performance levels. Airspace users will have access to these requirements and, based upon the flight being planned, additional information will be provided. This may include, among other things: · Aircraft type information for aerodrome gate planning · Aircraft wake performance for aerodrome capacity estimation · Navigation performance on departure or arrival at the requested aerodromes for capacity estimation · Environmental performance levels for environmental management · Achievable departure and arrival time performance Notified aerodromes and ASP use the provided information to conduct strategic DCB and related AOM activities to deliver capacity where required
1.1	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
1.1	FF-ICE	3.5.4 Flight Operation	Throughout the flight, the FF-ICE provides the necessary information for providing separation and designating the responsible separator and separation mode. Information on approvals for airborne applications (e.g., limited delegated separation, autonomous separation) and functioning, and approved equipment on-board will be contained in the flight information.
1.1	FF-ICE	3.6 Formation Flights	The FF-ICE Concept will support the possibility for aircraft to fly in a formation and for the formation to be controlled as a single entity, termed 'ICE-Formation' and is defined below.
1.1	FF-ICE	4.2 Information Elements	FF-ICE contains information necessary for the notifying, managing, and coordinating flights between members of the ATM Community.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.1	FF-ICE	4.2.1 Data Hierarchy	The FF-ICE concept requires the provision and exchange of a growing set of flight information. This flight information is structured into related groups of data elements which are: · Flight identifying information · Flight SAR information · Flight permission information · Flight preference information · Flight trajectory information (Performance information is organized within the trajectory in recognition that flight performance capabilities may differ at different segments along the trajectory.) · Additional information
1.1	FF-ICE	5.5 User Interactions	The introduction of the FF-ICE will allow the provision of airspace user constraints, preferences, priorities, and other potentially proprietary information. Through information security, this FF-ICE information can be protected.
1.1	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
1.1	FF-ICE	App B.1 Transition Steps - Step 2	In this step, even flight information entering the Air Traffic Management (ATM) System as an FPL would receive a GUFI generated according to an ICAO specification when accepted by the ATM network. The GUFI would be used in any further information sharing concerning the flights.
1.1	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.
1.1	9854	2.9 Information Services	2.9.1 The function of information services deals with the exchange and management of information used by the different processes and services. It will ensure the cohesion and linkage between the seven concept components described above.
1.1	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.
1.1	9854	2.9 Information Services	2.9.3 Information management will assemble the best possible integrated picture of the historical, real-time and planned or foreseen future state of the ATM situation. Information management will provide the basis for improved decision making by all ATM community members. Key to the concept will be the management of an information-rich environment.
1.1	9854	2.9 Information Services	2.9.7 ATM data has temporality and will change over time, but to varying degrees in terms of frequency or magnitude, varying from almost static to very dynamic. Information management will recognize and accommodate this temporality of data. This will impact the organization and issuance of data.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.1	9854	2.9 Information Services - Temporality and Issuance	2.9.13 The temporality of the information depends on its nature. Some data can be prepared in advance and are valid for a rather long period; other data change in real time and are obsolete immediately. As a principle, any valid and relevant information will be made available as soon as it becomes available.
1.1	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
1.1	Eng Needs	2.1 Accurate and Complete Data	2.1.2.1 Identify/document flight data required by stakeholders, with particular attention on data related to the ATM Concept Component and Flight Life Cycle Phases, discussed in ICAO 9854 and FF-ICE
1.1	Eng Needs	2.1 Accurate and Complete Data	2.1.2.4 Establish a global and unique way to identify a flight
1.1	Eng Needs	2.8 System Engineering Products	2.8.2.1 Articulate the NextGen concept of operations (see flight life cycle and concept component appendices)
1.1	FO ConOps	Section 2.2	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
1.1	FO ConOps	Section 2.3	On the first notification of flight intent, a globally unique flight identifier (GUFI) will be created that will allow all (with appropriate access rights) to view or modify information related to the same flight.
1.2			**FO shall include ownership, update authorization, subscription and access privileges for every FO data element and data service.**
1.2	FF-ICE	3.3 Overall Collaborative Environment	Information may be personalized, filtered, and accessed, as needed. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality. (§2.9.8)
1.2	FF-ICE	3.3 Overall Collaborative Environment	Authority to access and populate information items will be controlled in accordance with a set of rules known to the ATM Community. Users may have access to a subset of information within the FF-ICE. These access rights are not static and may change as a function of time or status of the flight/system. Rules will also depend on the specific instance of the FF-ICE (e.g., one airspace user may not alter other users' information).
1.2	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data "ownership") to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
1.2	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.2	FF-ICE	3.4.5 Effect of User Type on Timeline	While information provision is expected to be event-generated, it is recognized that there are a variety of categories of airspace users: · Airspace User who is a Seasonal Planner – This is the type of airspace user who decides to fly more than a month before the flight will take place; for example, an airline. · Airspace User who is a Medium-Term Planner — This is the type of airspace user who decides to fly between one day to one month before the flight will take place; for example, a charter operator or certain military airspace users. · On Demand Airspace User – This is the type of airspace user who decides to fly within the last 24 hours before the flight; for example, a business jet, air taxi, or certain types of military airspace user.
1.2	FF-ICE	3.5.4 Flight Operation	Throughout the flight, the FF-ICE provides the necessary information for providing separation and designating the responsible separator and separation mode. Information on approvals for airborne applications (e.g., limited delegated separation, autonomous separation) and functioning, and approved equipment on-board will be contained in the flight information.
1.2	FF-ICE	3.6 Formation Flights	The FF-ICE Concept will support the possibility for aircraft to fly in a formation and for the formation to be controlled as a single entity, termed 'ICE-Formation' and is defined below.
1.2	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of "denial of service" attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
1.2	FF-ICE	5.3 Information Access Requirements	The FF-ICE will consider requirements of member states regarding the need for information. Some of this information will have its access limited, and security measures will be in place to ensure that this access is strictly controlled. Additional security measures will likely be implemented for information confidentiality and integrity.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.2	FF-ICE	App C.1 meeting (operational Scenarios) requirements	The operational scenarios described in this appendix indicate that ASPs will verify compliance with requirements. This term may refer to several types of dynamic requirements imposed on a flight and the information provided. • Syntax – Format for FF-ICE information items is expected to comply with a standard that can be automatically checked for validity through automation. The approach will comply with industry standards and provide flexibility through versioning. Standards will be defined at a global level but accommodate regional extensions. • Content – Requirements may be specified regarding what information items must be provided at a certain point in the time evolution of a flight. (For example, ATM System performance may dictate the need for flight schedule information three months before estimated off block time [EOBT] for flights operating to a specific destination airport.) • Performance – Constraints on required performance levels may be imposed on flights based upon where/when they are operating. These constraints may be in such areas as navigation (e.g., RNP level) or environmental (e.g., noise) performance. • Accuracy – FF-ICE information may have to be specified to a given level of accuracy and reliability. • Access Permissions – Airspace users may require permission for access. • Operational constraints – Additional requirements on flight information may include necessary operational constraints on a flight's trajectory.
1.2	Eng Needs	2.1 Accurate and Complete Data	2.1.2.3 Define and establish authoritative sources for flight data elements
1.2	Eng Needs	2.1 Accurate and Complete Data	2.1.2.5 Identify flight data authorizations (stakeholders authorized to provide and receive each flight data element)
1.3			**FO data shall include Airspace User preference, permissions, priority, aircraft capabilities, performance, and constraints.**
1.3	FF-ICE	2.2 Advance Notification	The FF-ICE provides the ability for notification by the airspace user of preferences. This information can be supplied earlier to all authorized parties.
1.3	FF-ICE	2.2 Information Distribution	While FF-ICE must, by definition, impose requirements on how flight information is communicated between ATM Community members, these requirements are limited to the interface, and thus should not impose any restriction on how they individually store and process their data internally or mandate the use of any particular data model (such as a specific flight object).
1.3	FF-ICE	2.3 – R28	Ensure that flight parameters and aircraft performance characteristics are available to the ATM System
1.3	FF-ICE	2.3 – R177	Ensure that aircraft capabilities will be totally integrated into the collaborative decision-making process of the ATM Community and allow them to comply with all relevant ATM System requirements
1.3	FF-ICE	3.1 Principles	Allow aircraft to indicate their detailed performance capabilities, such as required navigation performance (RNP) level.
1.3	FF-ICE	3.3 Overall Collaborative Environment	In addition, not all information elements are required for all flights depending on desired performance levels.
1.3	FF-ICE	3.3 Overall Collaborative Environment	Information sharing can be adjusted to mitigate any proprietary concerns. (§2.9.9)

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.3	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
1.3	FF-ICE	3.5.4 Flight Operation	Throughout the flight, the FF-ICE provides the necessary information for providing separation and designating the responsible separator and separation mode. Information on approvals for airborne applications (e.g., limited delegated separation, autonomous separation) and functioning, and approved equipment on-board will be contained in the flight information.
1.3	FF-ICE	4.2.1 Data Hierarchy	The FF-ICE concept requires the provision and exchange of a growing set of flight information. This flight information is structured into related groups of data elements which are: · Flight identifying information · Flight SAR information · Flight permission information · Flight preference information · Flight trajectory information (Performance information is organized within the trajectory in recognition that flight performance capabilities may differ at different segments along the trajectory.) · Additional information
1.3	FF-ICE	5.5 User Interactions	The introduction of the FF-ICE will allow the provision of airspace user constraints, preferences, priorities, and other potentially proprietary information. Through information security, this FF-ICE information can be protected.
1.3	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
1.3	9854	2.9 Information Services	2.9.9 The information management function will allow all participants to adjust information sharing to mitigate any proprietary concerns. Sensitivity with regard to some data will continue to exist and will be managed within the information management function. Once an ATM community member agrees to release information, the data will be available to the extent required and will be made accessible to specified parties.
1.3	FO ConOps	Section 2.2	The FO provides the ability for notification by the airspace user of preferences. This information can be supplied earlier to all authorized parties.
1.4			**FO shall generate standardized valid, unambiguous, consistent and usable data elements.**
1.4	FF-ICE	2 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.4	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.
1.4	FF-ICE	2.2 Flexible Information Set	The FF-ICE data description provides flexibility in information formats. Field lengths can be expanded in future versions to support current requirements. Valid field list items, such as aircraft types, can be managed in a globally consistent manner
1.4	FF-ICE	2.2 Derivable Information	FF-ICE data formats support automation-to-automation interactions, enabling derived information to be generated by automation at the source.
1.4	FF-ICE	2.2 Derivable Information	The FF-ICE supports the provision of information services to ensure consistency of derived information.
1.4	FF-ICE	2.3 - R08	Ensure that the airspace user makes available, relevant operational information to the ATM System
1.4	FF-ICE	3.1 Principles	Avoid unnecessary limitations on information.
1.4	FF-ICE	3.1 Principles	Avoid the filing of unnecessary and unambiguously derivable information. Adopt a “file-by-exception” philosophy when information can be standardized.
1.4	FF-ICE	3.1 Principles	Ensure information is machine-readable and limit the need for free-text information.
1.4	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.
1.4	FF-ICE	3.3 Overall Collaborative Environment	The FF-ICE will be based on a globally consistent and unambiguous set of information elements. Providing consistent information does not imply that information requirements will be identical globally.
1.4	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.
1.4	FF-ICE	3.3 Overall Collaborative Environment	Information may be personalized, filtered, and accessed, as needed. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality. (§2.9.8)
1.4	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs
1.4	FF-ICE	4.1 Overview	SWIM—integrating all relevant ATM data—will form the basis for information management of the entire ATM System and will be essential for its efficient operation.
1.4	FF-ICE	5.4 Impact on Other ATS Messages	The multiple phases of the FF-ICE are expected to alter or remove the need for the various filed FPL update messages depending on implementation. The more dynamic and collaborative nature of flight information will require information be provided earlier and with more frequent updates with unambiguous reference to existing flight information

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.4	9854	2.9 Information Services	2.9.7 ATM data has temporality and will change over time, but to varying degrees in terms of frequency or magnitude, varying from almost static to very dynamic. Information management will recognize and accommodate this temporality of data. This will impact the organization and issuance of data.
1.4	9854	2.9 Information Services	2.9.8 Information may be personalized, filtered and accessed as needed. The initial quality of the information provided will be the responsibility of the originator; subsequent handling will not compromise its quality.
1.4	Eng Needs	2.2 Flight Data Management	2.2.2.2 Apply international standards for defining flight data elements to include identification of data element synonyms and antonyms (two or more users/systems use the same name to represent different entities)
1.4	Eng Needs	2.2 Flight Data Management	2.2.2.3 Apply international standards for managing (adding, deleting, modifying and retaining) flight data
1.4	FO ConOps	Section 1.2	Flight Data (information) elements must be unique and unambiguous across systems and with global ATM partners and knowledge and information associated with the data must be captured and available to the entire NAS, possibly through a formal ontology.
1.4	FO ConOps	Section 2.2	The FO will provide the ability to share the same flight information across a broad range of collaborating participants before and during a flight.
1.4	FO ConOps	Section 2.6	The FO data description provides flexibility in information formats. Field lengths can be expanded in future versions to support new requirements. Valid field list items, such as aircraft types, can be managed in a globally consistent manner.
1.4	FO ConOps	Section 2.7	FO information will be provided in actionable formats
1.5			**FO data and services shall enable and support airspace users to provide enhanced early intent flight information.**
1.5	FF-ICE	2 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.
1.5	FF-ICE	2.2 Sharing Flight Information	The FF-ICE will replace all existing data message formats between ATM Community members about flight intent and flight progression.
1.5	FF-ICE	2.2 Advance Notification	The airspace user will be able to notify flight intent up to a year in advance. Details will be able to be progressively supplied (as information becomes reliable enough to communicate).
1.5	FF-ICE	2.2 Advance Notification	Mandatory requirements for data and requirements for submission are balanced to enhance flexibility and ensure reliability of information—however, airspace users will be encouraged to supply information as soon as it becomes reliable enough to be useful to assist in ATM planning. Service providers will be reminded to consider all performance areas, including flexibility to accommodate infrequent subsequent changes that appear to be in good faith.
1.5	FF-ICE	2.2 Inconsistent Flight Information	On the first notification of flight intent, a globally unique flight identifier (GUFI) will be created that will allow all (with appropriate access rights) to view or modify information related to the same flight.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.5	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
1.5	FF-ICE	3.1 Principles	Allow for an early indication of intent.
1.5	FF-ICE	3.3 Overall Collaborative Environment	Information may be personalized, filtered, and accessed, as needed. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality. (§2.9.8)
1.5	FF-ICE	3.4 FF-ICE Timeline	Whereas currently an aircraft operator may file a single FPL form, in the future, the operator will provide increasing information about a flight as time approaches departure and throughout the flight. Some of this information is known ahead of time with relative certainty (e.g., departure and arrival airport), other information will be better known closer to departure (e.g., route of flight, estimated time en-route), and some could change dynamically throughout the flight (e.g., estimated time of departure, agreed trajectory).
1.5	FF-ICE	3.4 FF-ICE Timeline	Initial information provision may occur at any point along the timeline. For example, differing airspace users may have different planning horizons as described in Section 3.4.5. This initial information will be provided through a designated point-of-entry (POE, see Appendix H.1.5) and to an ASP typically applicable to the flight's departure point. Some ASPs may accommodate multiple POEs, and some ASPs may accommodate the receipt of initial flight information from POEs not explicitly associated with a flight's departure point. Clarity regarding responsibility for information is aided by information audit trails.
1.5	FF-ICE	3.4.1 Scheduling and Strategic Activities	Nothing precludes an operator from supplying more information at an earlier point in the timeline.
1.5	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
1.5	FF-ICE	App B.1 Transition Steps - Step 5	Some ASPs who wish to make use of early submission of FF-ICE information may develop a shared forecast service based on information provided in the early submissions.
1.5	FO ConOps	Section 2.2	The FO will replace all existing data message formats between ATM Community members about flight intent and flight progress.
1.5	FO ConOps	Section 2.3	On the first notification of flight intent, a globally unique flight identifier (GUFI) will be created that will allow all (with appropriate access rights) to view or modify information related to the same flight.
1.6			**FO data and services shall enable and support 4D Trajectory planning and management for flights.**

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.6	FF-ICE	2 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.
1.6	FF-ICE	2.3 – R12	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
1.6	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
1.6	FF-ICE	3.1 Principles	Support 4D management by trajectory.
1.6	FF-ICE	3.3.1 Elts of the ICE	Specifications on providing required information for the FF-ICE will also be expressed using aeronautical information. For example, levels of precision required for trajectory information provision can be dynamic and dependent on airspace constructs such as routing. Requirements may also vary regionally based upon circumstances and desired performance levels.
1.6	FF-ICE	3.3.1 Elts of the ICE	Separation provision activities will be conducted by the designated separator, which may be an ASP or the airspace user. In a trajectory-based environment, this activity operates on the 4D trajectory supplied as part of flight information, supplemented with up-to-date surveillance information. Separation provision must also consider the overall ATM situation, including dynamical aeronautical information, weather, and infrastructure status as shown in Figure 3.3-5.
1.6	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
1.6	FF-ICE	3.5.3 Tactical Operational Planning	Prior to departure, not all trajectory information will be supplied by the airspace user. For example, the airspace user may be concerned with runway, pushback, and wheels-up times, but would accommodate any valid taxi-path.
1.6	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
1.6	FF-ICE	4.2.1 Data Hierarchy	The FF-ICE concept requires the provision and exchange of a growing set of flight information. This flight information is structured into related groups of data elements which are: · Flight identifying information · Flight SAR information · Flight permission information · Flight preference information · Flight trajectory information (Performance information is organized within the trajectory in recognition that flight performance capabilities may differ at different segments along the trajectory.) · Additional information
1.6	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
1.6	FF-ICE	App C.1 meeting (operational Scenarios) requirements	The operational scenarios described in this appendix indicate that ASPs will verify compliance with requirements. This term may refer to several types of dynamic requirements imposed on a flight and the information provided. • Syntax – Format for FF-ICE information items is expected to comply with a standard that can be automatically checked for validity through automation. The approach will comply with industry standards and provide flexibility through versioning. Standards will be defined at a global level but accommodate regional extensions. • Content – Requirements may be specified regarding what information items must be provided at a certain point in the time evolution of a flight. (For example, ATM System performance may dictate the need for flight schedule information three months before estimated off block time [EOBT] for flights operating to a specific destination airport.) • Performance – Constraints on required performance levels may be imposed on flights based upon where/when they are operating. These constraints may be in such areas as navigation (e.g., RNP level) or environmental (e.g., noise) performance. • Accuracy – FF-ICE information may have to be specified to a given level of accuracy and reliability. • Access Permissions – Airspace users may require permission for access. • Operational constraints – Additional requirements on flight information may include necessary operational constraints on a flight's trajectory.
2.1			**FO shall establish processes which efficiently, effectively, and accurately gather and interrelate data in support of NextGen ATM-related operations.**
2.1	FF-ICE	2.2 Advance Notification	Mandatory requirements for data and requirements for submission are balanced to enhance flexibility and ensure reliability of information—however, airspace users will be encouraged to supply information as soon as it becomes reliable enough to be useful to assist in ATM planning. Service providers will be reminded to consider all performance areas, including flexibility to accommodate infrequent subsequent changes that appear to be in good faith.
2.1	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.1	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.
2.1	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data “ownership”) to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
2.1	FF-ICE	3.3.1 Elts of the ICE	Separation provision activities will be conducted by the designated separator, which may be an ASP or the airspace user. In a trajectory-based environment, this activity operates on the 4D trajectory supplied as part of flight information, supplemented with up-to-date surveillance information. Separation provision must also consider the overall ATM situation, including dynamical aeronautical information, weather, and infrastructure status as shown in Figure 3.3-5.
2.1	FF-ICE	3.4 FF-ICE Timeline	Whereas currently an aircraft operator may file a single FPL form, in the future, the operator will provide increasing information about a flight as time approaches departure and throughout the flight. Some of this information is known ahead of time with relative certainty (e.g., departure and arrival airport), other information will be better known closer to departure (e.g., route of flight, estimated time en-route), and some could change dynamically throughout the flight (e.g., estimated time of departure, agreed trajectory).
2.1	9854	Appendix D Expectations - Global Interoperability	The ATM system should be based on global standards and uniform principles to ensure the technical and operational interoperability of ATM systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.
2.1	9854	Appendix G EVOLUTION TO OPERATIONAL CONCEPT	1.2 The operational concept is adaptable to the operational environment of all States or regions by being scalable to meet their specific needs. One State or region, or a specific area or location within a State, may have an immediate imperative to improve safety, while another State or region may have an immediate imperative to improve efficiency.
2.1	Eng Needs	2.1 Accurate and Complete Data	2.1.2.1 Identify/document flight data required by stakeholders, with particular attention on data related to the ATM Concept Component and Flight Life Cycle Phases, discussed in ICAO 9854 and FF-ICE
2.1	Eng Needs	2.2 Flight Data Management	2.2.2.2 Apply international standards for defining flight data elements to include identification of data element synonyms and antonyms (two or more users/systems use the same name to represent different entities)
2.1	FO ConOps	Section 2.4	In the end state, the FO provides a globally consistent mechanism and consistent interface for the provision and receipt of FO information.
2.2			**FO shall develop, support, and enable global processes that refine and validate the data, meta-data, and automation in accordance with the Global ATM Operational Concept (ICAO 9854).**
2.2	FF-ICE	3 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.2	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.
2.2	FF-ICE	2.2 Flexible Information Set	The FF-ICE supports unambiguous versioning of information with validation against a published standard. Changes to the FF-ICE can be specified in new versions of the standard while standard practices ensure that formats are adhered to. Backward compatibility between different versions allows interoperability between ATM Community members without requiring coordinated transitions.
2.2	FF-ICE	2.2 Flexible Information Set	The FF-ICE data description provides flexibility in information formats. Field lengths can be expanded in future versions to support current requirements. Valid field list items, such as aircraft types, can be managed in a globally consistent manner
2.2	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.
2.2	FF-ICE	3.3 Overall Collaborative Environment	Information may be personalized, filtered, and accessed, as needed. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality. (§2.9.8)
2.2	FF-ICE	3.3 Overall Collaborative Environment	Information management will use globally harmonized information attributes. (§2.9.11)
2.2	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data “ownership”) to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
2.2	FF-ICE	4.2 Information Elements	One of these domain specific data models would consider all flight information. The flight information to be exchanged needs to be modeled explicitly to allow a precise and concrete definition to be agreed upon. The model needs to pick up the currently used flight information elements and expand them considerably to growing information needs. It needs to be consistent with work that has already defined some data models and the associated services within specific domains (e.g., Aeronautical Information).

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.2	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
2.2	9854	Appendix D Expectations - Global Interoperability	The ATM system should be based on global standards and uniform principles to ensure the technical and operational interoperability of ATM systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.
2.2	FO ConOps	Section 1.2	The repository for the flight information (the harmonized and semantically complete set of Flight Data Elements) must allow addition of new or updated Data Elements easily.
2.2	FO ConOps	Section 2.6	The FO data description provides flexibility in information formats. Field lengths can be expanded in future versions to support new requirements. Valid field list items, such as aircraft types, can be managed in a globally consistent manner.
2.3			**FO shall develop optimal, to include flexibility, machine-readable information to ensure appropriate automation.**
2.3	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.
2.3	FF-ICE	2.2 Flexible Information Set	The FF-ICE supports unambiguous versioning of information with validation against a published standard. Changes to the FF-ICE can be specified in new versions of the standard while standard practices ensure that formats are adhered to. Backward compatibility between different versions allows interoperability between ATM Community members without requiring coordinated transitions.
2.3	FF-ICE	2.2 Flexible Information Set	The FF-ICE data description provides flexibility in information formats. Field lengths can be expanded in future versions to support current requirements. Valid field list items, such as aircraft types, can be managed in a globally consistent manner
2.3	FF-ICE	2.2 Derivable Information	The FF-ICE supports the provision of information services to ensure consistency of derived information.
2.3	FF-ICE	3.1 Principles	Consider the cost impact on providers and consumers of flight information.
2.3	FF-ICE	3.1 Principles	Ensure information is machine-readable and limit the need for free-text information.
2.3	Eng Needs	2.2 Flight Data Management	2.2.2.4 Minimize, to the extent possible, limitations on the flight information
2.3	Eng Needs	2.2 Flight Data Management	2.2.2.5 Ensure flight information is machine readable and limits the use of free-text information

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.3	FO ConOps	Section 1.2	"FO will be in a format which enables automation to read and perform a variety of functions, thereby eliminating the need to re-enter data."
2.4			**FO shall develop and maintain an operationally agnostic data model representation of the information within the flight domain.**
2.4	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.
2.4	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs
2.4	FF-ICE	3.3.1 Elts of the ICE	AUO will face requirements on performance and/or approved capabilities, both static and dynamic. Some of these requirements are expected to be linked to aeronautical information. For example, certain airspace volumes or routes (where defined) will require levels of navigation performance. A mechanism must exist to specify and disseminate these requirements. These requirements may also be altered as a result of AOM activities or weather conditions.
2.4	FF-ICE	3.5.1 Scheduling and Strategic Activities	In a performance-based environment, certain regions will require more stringent information provision in order to achieve required performance levels. Airspace users will have access to these requirements and, based upon the flight being planned, additional information will be provided. This may include, among other things: · Aircraft type information for aerodrome gate planning · Aircraft wake performance for aerodrome capacity estimation · Navigation performance on departure or arrival at the requested aerodromes for capacity estimation · Environmental performance levels for environmental management · Achievable departure and arrival time performance Notified aerodromes and ASP use the provided information to conduct strategic DCB and related AOM activities to deliver capacity where required
2.4	FF-ICE	4.2 Information Elements	The future ATM System will depend on an overall ATM information reference model which will provide a neutral (i.e. no constraints on implementation) definition of ATM information.
2.4	FF-ICE	4.2 Information Elements	One of these domain specific data models would consider all flight information. The flight information to be exchanged needs to be modeled explicitly to allow a precise and concrete definition to be agreed upon. The model needs to pick up the currently used flight information elements and expand them considerably to growing information needs. It needs to be consistent with work that has already defined some data models and the associated services within specific domains (e.g., Aeronautical Information).
2.4	Eng Needs	2.2 Flight Data Management	2.2.2.1 Establish flexible, stable, and consistent flight data models, structures and formats
2.4	FO ConOps	Section 1.4	FIXM has been identified as the data standard to be used by the FAA to exchange FO data within the NAS and between the FAA and other ANSPs. FIXM will standardize current and future elements to increase interoperability and data exchange between systems that require FO information.
2.4	FO ConOps	Section 1.2	Authorized stakeholders and ANSPs may electronically access consistent flight data that is tailored to their specific need and use.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.5			**FO shall define and regulate the chronological sequence of flight data input, updates and sharing in support of automated flight management and execution.**
2.5	FF-ICE	2.2 Sharing Flight Information	The FF-ICE will provide the ability to share the same flight information across a broad range of collaborating participants before and during a flight.
2.5	FF-ICE	2.2 Sharing Flight Information	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
2.5	FF-ICE	3.3 Overall Collaborative Environment	Authority to access and populate information items will be controlled in accordance with a set of rules known to the ATM Community. Users may have access to a subset of information within the FF-ICE. These access rights are not static and may change as a function of time or status of the flight/system. Rules will also depend on the specific instance of the FF-ICE (e.g., one airspace user may not alter other users' information).
2.5	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data "ownership") to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
2.5	FF-ICE	3.3.1 Elts of the ICE	For performance reasons, different information elements will be required under different circumstances, locations, and times. The required set of information elements and conditions on providing information will be specified in requirements. Both global and regional requirements will exist. . As an example, one region may require airport slot information for coordinated airports at some time before estimated off block time (EOBT). A mechanism will be in place to ensure, through automated means, that information requirements are complied with. Compliance with requirements may be real-time (e.g., information item is provided by a specified time) or post-analysis (e.g., early intent information meets accuracy requirements).
2.5	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs
2.5	FF-ICE	3.3.1 Elts of the ICE	Separation provision activities will be conducted by the designated separator, which may be an ASP or the airspace user. In a trajectory-based environment, this activity operates on the 4D trajectory supplied as part of flight information, supplemented with up-to-date surveillance information. Separation provision must also consider the overall ATM situation, including dynamical aeronautical information, weather, and infrastructure status as shown in Figure 3.3-5.
2.5	FF-ICE	3.4 FF-ICE Timeline	Whereas currently an aircraft operator may file a single FPL form, in the future, the operator will provide increasing information about a flight as time approaches departure and throughout the flight. Some of this information is known ahead of time with relative certainty (e.g., departure and arrival airport), other information will be better known closer to departure (e.g., route of flight, estimated time en-route), and some could change dynamically throughout the flight (e.g., estimated time of departure, agreed trajectory).

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.5	FF-ICE	3.4 FF-ICE Timeline	Since the flight information process is expected to be ongoing, requirements for the provision of information will be event-driven. These can include certain events such as: the availability of a significant piece of data such as weather, a fixed time before scheduled pushback, a time prior to entry into airspace, the issuance of a clearance, or a change in responsibility. One example of an information provision requirement would be that before departure, the airspace user shall supply information necessary for the provision of emergency services.
2.5	FF-ICE	3.4 FF-ICE Timeline	Initial information provision may occur at any point along the timeline. For example, differing airspace users may have different planning horizons as described in Section 3.4.5. This initial information will be provided through a designated point-of-entry (POE, see Appendix H.1.5) and to an ASP typically applicable to the flight's departure point. Some ASPs may accommodate multiple POEs, and some ASPs may accommodate the receipt of initial flight information from POEs not explicitly associated with a flight's departure point. Clarity regarding responsibility for information is aided by information audit trails.
2.5	FF-ICE	3.4 FF-ICE Timeline	Requirements will be levied on participants to supply specific information by certain deadlines tied to events.
2.5	FF-ICE	3.4 FF-ICE Timeline	The FF-ICE will be updated dynamically throughout the operation of a flight.
2.5	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace user-provided information is subject to change as information becomes known with greater certainty closer to departure. Operators providing this information are expected to update it as more accurate planning information becomes available.
2.5	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace users may wish to provide information for flights which will operate in the same manner on a repeated basis. This is acceptable
2.5	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
2.5	FF-ICE	3.5.4 Flight Operation	Throughout the flight, the FF-ICE provides the necessary information for providing separation and designating the responsible separator and separation mode. Information on approvals for airborne applications (e.g., limited delegated separation, autonomous separation) and functioning, and approved equipment on-board will be contained in the flight information.
2.5	FF-ICE	5.4 Impact on Other ATS Messages	The multiple phases of the FF-ICE are expected to alter or remove the need for the various filed FPL update messages depending on implementation. The more dynamic and collaborative nature of flight information will require information be provided earlier and with more frequent updates with unambiguous reference to existing flight information
2.5	9854	2.9 Information Services	2.9.7 ATM data has temporality and will change over time, but to varying degrees in terms of frequency or magnitude, varying from almost static to very dynamic. Information management will recognize and accommodate this temporality of data. This will impact the organization and issuance of data.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
2.5	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
2.5	FO ConOps	Section 2.2	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
2.5	FO ConOps	Section 2.3	On the first notification of flight intent, a globally unique flight identifier (GUFI) will be created that will allow all (with appropriate access rights) to view or modify information related to the same flight.
3.1			**FO shall provide the ability to share relevant and timely flight information across a broad range of authorized ATM participants throughout the life cycle of a flight.**
3.1	FF-ICE	3 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.
3.1	FF-ICE	2.2 Sharing Flight Information	The FF-ICE will provide the ability to share the same flight information across a broad range of collaborating participants before and during a flight.
3.1	FF-ICE	2.2 Sharing Flight Information	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
3.1	FF-ICE	2.2 Inconsistent Flight Information	On the first notification of flight intent, a globally unique flight identifier (GUFI) will be created that will allow all (with appropriate access rights) to view or modify information related to the same flight.
3.1	FF-ICE	2.3 - R08	Ensure that the airspace user makes available, relevant operational information to the ATM System
3.1	FF-ICE	2.3 – R12	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
3.1	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
3.1	FF-ICE	3.1 Principles	Allow aircraft to indicate their detailed performance capabilities, such as required navigation performance (RNP) level.
3.1	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.1	FF-ICE	3.3 Overall Collaborative Environment	Information must be shared on a system-wide basis. (§2.9.5)
3.1	FF-ICE	3.3.1 Elts of the ICE	Participants are expected to provide and consume shared information, subject to tailored information requirements, to deliver the Concept component functionality.
3.1	FF-ICE	3.4 FF-ICE Timeline	Whereas currently an aircraft operator may file a single FPL form, in the future, the operator will provide increasing information about a flight as time approaches departure and throughout the flight. Some of this information is known ahead of time with relative certainty (e.g., departure and arrival airport), other information will be better known closer to departure (e.g., route of flight, estimated time en-route), and some could change dynamically throughout the flight (e.g., estimated time of departure, agreed trajectory).
3.1	FF-ICE	3.4 FF-ICE Timeline	Initial information provision may occur at any point along the timeline. For example, differing airspace users may have different planning horizons as described in Section 3.4.5. This initial information will be provided through a designated point-of-entry (POE, see Appendix H.1.5) and to an ASP typically applicable to the flight's departure point. Some ASPs may accommodate multiple POEs, and some ASPs may accommodate the receipt of initial flight information from POEs not explicitly associated with a flight's departure point. Clarity regarding responsibility for information is aided by information audit trails.
3.1	FF-ICE	3.4 FF-ICE Timeline	The FF-ICE will be updated dynamically throughout the operation of a flight.
3.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace users may wish to provide information for flights which will operate in the same manner on a repeated basis. This is acceptable
3.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Nothing precludes an operator from supplying more information at an earlier point in the timeline.
3.1	FF-ICE	3.4.5 Effect of User Type on Timeline	While information provision is expected to be event-generated, it is recognized that there are a variety of categories of airspace users: · Airspace User who is a Seasonal Planner – This is the type of airspace user who decides to fly more than a month before the flight will take place; for example, an airline. · Airspace User who is a Medium-Term Planner — This is the type of airspace user who decides to fly between one day to one month before the flight will take place; for example, a charter operator or certain military airspace users. · On Demand Airspace User – This is the type of airspace user who decides to fly within the last 24 hours before the flight; for example, a business jet, air taxi, or certain types of military airspace user.
3.1	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
3.1	FF-ICE	4.1 Overview	SWIM—integrating all relevant ATM data—will form the basis for information management of the entire ATM System and will be essential for its efficient operation.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.1	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.
3.1	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
3.1	FF-ICE	4.2.1 Data Hierarchy	The FF-ICE concept requires the provision and exchange of a growing set of flight information. This flight information is structured into related groups of data elements which are: · Flight identifying information · Flight SAR information · Flight permission information · Flight preference information · Flight trajectory information (Performance information is organized within the trajectory in recognition that flight performance capabilities may differ at different segments along the trajectory.) · Additional information

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.1	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of “denial of service” attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
3.1	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
3.1	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.1	FF-ICE	App C.1 meeting (operational Scenarios) requirements	The operational scenarios described in this appendix indicate that ASPs will verify compliance with requirements. This term may refer to several types of dynamic requirements imposed on a flight and the information provided. • Syntax – Format for FF-ICE information items is expected to comply with a standard that can be automatically checked for validity through automation. The approach will comply with industry standards and provide flexibility through versioning. Standards will be defined at a global level but accommodate regional extensions. • Content – Requirements may be specified regarding what information items must be provided at a certain point in the time evolution of a flight. (For example, ATM System performance may dictate the need for flight schedule information three months before estimated off block time [EOBT] for flights operating to a specific destination airport.) • Performance – Constraints on required performance levels may be imposed on flights based upon where/when they are operating. These constraints may be in such areas as navigation (e.g., RNP level) or environmental (e.g., noise) performance. • Accuracy – FF-ICE information may have to be specified to a given level of accuracy and reliability. • Access Permissions – Airspace users may require permission for access. • Operational constraints – Additional requirements on flight information may include necessary operational constraints on a flight's trajectory.
3.1	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.
3.1	9854	2.9 Information Services	2.9.8 Information may be personalized, filtered and accessed as needed. The initial quality of the information provided will be the responsibility of the originator; subsequent handling will not compromise its quality.
3.1	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
3.1	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.6 Ensure that flight data is available when it is needed (data availability)
3.1	Eng Needs	2.11 Data Exchange System and Network Management	2.11.2.4 Define and establish communication capabilities needed to support stakeholder flight data exchange requirements and harmonize the exchange among managing authorities
3.1	FO ConOps	Section 1.2	Authorized stakeholders and ANSPs may electronically access consistent flight data that is tailored to their specific need and use.
3.1	FO ConOps	Section 2.2	The FO will provide the ability to share the same flight information across a broad range of collaborating participants before and during a flight.
3.2			**FO shall enable and support higher levels of collaboration and automated CDM than was available prior to NextGen implementation.**

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.2	FF-ICE	2 Drivers of Change	The Global ATM Operational Concept has greater data requirements than can be supported by the existing flight planning provisions. These include system-wide information sharing, providing early intent data, management by trajectory, CDM, and high automation support requiring machine readability and unambiguous information.
3.2	FF-ICE	2.2 Sharing Flight Information	The FF-ICE will provide the ability to share the same flight information across a broad range of collaborating participants before and during a flight.
3.2	FF-ICE	2.3 – R12	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
3.2	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
3.2	FF-ICE	2.3 – R178	Ensure that aircraft capabilities will be totally integrated into the collaborative decision-making process of the ATM Community and allow them to comply with all relevant ATM System requirements
3.2	FF-ICE	3.1 Principles	Incorporate information for increased and more automated CDM.
3.2	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
3.2	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.2	9854	2.9 Information Services	2.9.3 Information management will assemble the best possible integrated picture of the historical, real-time and planned or foreseen future state of the ATM situation. Information management will provide the basis for improved decision making by all ATM community members. Key to the concept will be the management of an information-rich environment.
3.2	9854	2.9 Information Services	2.9.10 Information management will achieve a seamless transfer of relevant information between parties in a flexible, adaptable and scalable information environment.
3.2	9854	Appendix D Expectations - Access and equity	The global ATM system should ensure equity for all users that have access to a given airspace or service. Generally, the first aircraft ready to use the ATM resources will receive priority, except where significant overall safety or system operational efficiency would accrue or national defense considerations or interests dictate that priority be determined on a different basis.
3.3			**FO shall enable and support a globally consistent mechanism and interface for providing and receiving flight information.**
3.3	FF-ICE	2.2 Information Distribution	In the end state, the FF-ICE provides a globally consistent mechanism and consistent interface for providing and receiving FF-ICE information.
3.3	FF-ICE	3.3 Overall Collaborative Environment	Information must be shared on a system-wide basis. (§2.9.5)
3.3	FF-ICE	3.3 Overall Collaborative Environment	Once the FF-ICE is created, all interested and authorized parties will have access to the information it contains. One service may provide information upon request. Another service may provide updates as the information changes. These updates will be based upon criteria specified by the information consumer. These criteria may require notification that a flight is no longer applicable should the flight information change.
3.3	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data “ownership”) to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
3.3	FF-ICE	3.5.3 Tactical Operational Planning	Prior to departure, not all trajectory information will be supplied by the airspace user. For example, the airspace user may be concerned with runway, pushback, and wheels-up times, but would accommodate any valid taxi-path.
3.3	FF-ICE	4.1 Overview	The future flight information technical environment which will be highly interoperable and support the exchange of information as detailed in this concept.
3.3	FF-ICE	4.2 Information Elements	FF-ICE contains information necessary for the notifying, managing, and coordinating flights between members of the ATM Community.
3.3	FF-ICE	5.1 Characteristics of Transition	The FF-ICE will replace the present FPL as the single, global standardized message exchange process for FPL information.
3.3	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
3.3	Eng Needs	2.3 Flight Data Exchange Management	2.3.2.1 Implement consistent, reliable, and industry-accepted data exchange processes, standards and mechanisms
3.3	FO ConOps	Section 1.2	The FO environment will ensure that consistent information is shared NAS-wide. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.3	FO ConOps	Section 2.4	In the end state, the FO provides a globally consistent mechanism and consistent interface for the provision and receipt of FO information.
3.4			**FO shall be designed to operate within SWIM.**
3.4	FF-ICE	2.2 Information Distribution	The FF-ICE concept recognizes that performance considerations may result in not everyone being able to participate at the same level of information sharing. Thus, for an extended time there will be “pockets” of SWIM capabilities. Consideration is given to how advanced SWIM capabilities can be maximized even with areas that have not yet enabled advanced SWIM capabilities.
3.4	FF-ICE	4.1 Overview	SWIM—integrating all relevant ATM data—will form the basis for information management of the entire ATM System and will be essential for its efficient operation.
3.4	FF-ICE	4.3 System-Wide Information Management	SWIM is supported by a suitable architecture allowing exchange of data and ATM services across the whole ATM System.
3.4	FF-ICE	App B.1 Transition Steps - Step 2	The FF-ICE concept includes a high-level description for submission, retrieval, and dissemination of FF-ICE information by means of publish/subscribe and request/reply mechanisms supported by System Wide Information Management (SWIM) architecture.
3.4	FF-ICE	App B.1 Transition Steps - Step 2	This (SWIM) architecture could facilitate the later steps by providing a ‘converter’ function between the FPL and FF-ICE information format and content.
3.4	FF-ICE	App B.1 Transition Steps - Step 1	Specifications will be needed for the (SWIM region-to-region) interface in order to ensure the required level of interoperability.
3.4	FF-ICE	App B.1 Transition Steps - Step 1	An end-to-end delivery assurance scheme will be required (for SWIM region-to-region interfaces), consistent with the level of criticality of applications using the provided data.
3.4	FF-ICE	App B.1 Transition Steps - Step 1	The example provided (of SWIM region-to-region interfaces) can be extended to other interactions (e.g., request/reply) beyond publish/subscribe.
3.4	FO ConOps	Section 4.2	SWIM will form the technical basis for information exchange/management of the FO data and will be essential for its efficient operation
3.5			**FO shall provide a mechanism (or mechanisms) to exchange defined proprietary data, flight preference data, performance data, and FO information updates among authorized users.**
3.5	FF-ICE	2.2 Advance Notification	The FF-ICE provides the ability for notification by the airspace user of preferences. This information can be supplied earlier to all authorized parties.
3.5	FF-ICE	2.2 Information Security	Whether for commercial sensitivities or aviation security purposes, there is a need for increased information security. For example, an airline may be willing to share information with a service provider to permit an improved performance of the ATM System but would be unwilling for that same information to be available to an airline competitor. - The FF-ICE exchange mechanisms support layered information security
3.5	FF-ICE	2.3 – R28	Ensure that flight parameters and aircraft performance characteristics are available to the ATM System
3.5	FF-ICE	2.3 – R177	Ensure that aircraft capabilities will be totally integrated into the collaborative decision-making process of the ATM Community and allow them to comply with all relevant ATM System requirements
3.5	FF-ICE	3.1 Principles	Allow aircraft to indicate their detailed performance capabilities, such as required navigation performance (RNP) level.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.5	FF-ICE	3.3 Overall Collaborative Environment	The FF-ICE will be based on a globally consistent and unambiguous set of information elements. Providing consistent information does not imply that information requirements will be identical globally.
3.5	FF-ICE	3.3 Overall Collaborative Environment	Information sharing can be adjusted to mitigate any proprietary concerns. (§2.9.9)
3.5	FF-ICE	4.2.1 Data Hierarchy	The FF-ICE concept requires the provision and exchange of a growing set of flight information. This flight information is structured into related groups of data elements which are: · Flight identifying information · Flight SAR information · Flight permission information · Flight preference information · Flight trajectory information (Performance information is organized within the trajectory in recognition that flight performance capabilities may differ at different segments along the trajectory.) · Additional information
3.5	FF-ICE	5.5 User Interactions	The introduction of the FF-ICE will allow the provision of airspace user constraints, preferences, priorities, and other potentially proprietary information. Through information security, this FF-ICE information can be protected.
3.5	FF-ICE	App B.1 Transition Steps - Step 2	This (SWIM) architecture could facilitate the later steps by providing a 'converter' function between the FPL and FF-ICE information format and content.
3.5	9854	2.9 Information Services	2.9.9 The information management function will allow all participants to adjust information sharing to mitigate any proprietary concerns. Sensitivity with regard to some data will continue to exist and will be managed within the information management function. Once an ATM community member agrees to release information, the data will be available to the extent required and will be made accessible to specified parties.
3.6			**FO shall ensure that air defense systems, military control systems, SAR organizations, accident/incident investigation authorities, law enforcement, and regulatory authorities receive the needed timely and accurate information on flights and ATM system intents.**
3.6	FF-ICE	4.2.1 Data Hierarchy	The FF-ICE concept requires the provision and exchange of a growing set of flight information. This flight information is structured into related groups of data elements which are: · Flight identifying information · Flight SAR information · Flight permission information · Flight preference information · Flight trajectory information (Performance information is organized within the trajectory in recognition that flight performance capabilities may differ at different segments along the trajectory.) · Additional information
3.6	9854	2.9 Information Services - other essential services	2.9.20 (a) Air defense systems and military control systems will need timely and accurate information on flights and ATM system intents. They will be involved in airspace reservations and notification of air activities and in enforcing measures related to security.
3.6	9854	2.9 Information Services - other essential services	2.9.20 (b) Search and rescue organizations will need timely and accurate search and rescue information on aircraft in distress and accidents because such information plays an important role in the quality of the search function.
3.6	9854	2.9 Information Services - other essential services	2.9.20 (c) Aviation accident/incident investigation authorities will need to exploit recordings of flight trajectory data and ATM actions.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.6	9854	2.9 Information Services - other essential services	2.9.20 (d) Law enforcement (including customs and police authorities) will need flight identification and flight trajectory data, as well as information about traffic at aerodromes.
3.6	9854	2.9 Information Services - other essential services	2.9.20 (e) Regulatory authorities will need to implement the regulatory framework within the legal powers given to them and to monitor the safety status of the ATM system.
3.6	9854	Appendix D Expectations - Access and equity	The global ATM system should ensure equity for all users that have access to a given airspace or service. Generally, the first aircraft ready to use the ATM resources will receive priority, except where significant overall safety or system operational efficiency would accrue or national defense considerations or interests dictate that priority be determined on a different basis.
3.7			**FO data exchange shall enhance flight data interoperability and accessibility.**
3.7	FF-ICE	3.3 Overall Collaborative Environment	Authority to access and populate information items will be controlled in accordance with a set of rules known to the ATM Community. Users may have access to a subset of information within the FF-ICE. These access rights are not static and may change as a function of time or status of the flight/system. Rules will also depend on the specific instance of the FF-ICE (e.g., one airspace user may not alter other users' information).
3.7	FF-ICE	3.3 Overall Collaborative Environment	Once the FF-ICE is created, all interested and authorized parties will have access to the information it contains. One service may provide information upon request. Another service may provide updates as the information changes. These updates will be based upon criteria specified by the information consumer. These criteria may require notification that a flight is no longer applicable should the flight information change.
3.7	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data "ownership") to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
3.7	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
3.7	FF-ICE	4.2 Information Elements	FF-ICE contains information necessary for the notifying, managing, and coordinating flights between members of the ATM Community.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.7	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
3.7	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of “denial of service” attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
3.7	9854	2.9 Information Services	2.9.4 Information management will contribute to meeting the expectations of the ATM community through all operational services. Its more direct contribution to improvements in the ATM system will be in the quality of the information that will, in turn, provide significant additional benefits. In particular, the wide availability of high-quality, relevant aeronautical data presented to all airspace users in a usable format will contribute to increased aviation safety.
3.7	9854	2.9 Information Services	2.9.6 For the ATM system to operate at its full potential, pertinent information will be available when and where required.
3.7	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
3.7	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
3.7	9854	Appendix D Expectations - Global Interoperability	The ATM system should be based on global standards and uniform principles to ensure the technical and operational interoperability of ATM systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.
3.7	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.1 Ensure flight data access control and interface accountability (e.g. auditing)
3.8			**FO shall enable authorized users to personalize and filter their flight data exchanges in support of their efforts to access only the flight data they need.**
3.8	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.
3.8	FF-ICE	3.3 Overall Collaborative Environment	Information may be personalized, filtered, and accessed, as needed. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality. (§2.9.8)
3.8	FF-ICE	5.6.1 Transition Steps	From a user perspective, the main characteristics of the FF-ICE can be summarized as: · Globally Unique Flight Identifier (GUFI) · Airspace users submitting early flight information · Provision and exchange of full FF-ICE information including 4D trajectory · Submission, retrieval, and dissemination of FF-ICE information
3.8	9854	2.9 Information Services	2.9.8 Information may be personalized, filtered and accessed as needed. The initial quality of the information provided will be the responsibility of the originator; subsequent handling will not compromise its quality.
3.8	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
4.1			**FO shall identify and make available flight data and data exchange requirements.**
4.1	FF-ICE	3.3 Overall Collaborative Environment	Once the FF-ICE is created, all interested and authorized parties will have access to the information it contains. One service may provide information upon request. Another service may provide updates as the information changes. These updates will be based upon criteria specified by the information consumer. These criteria may require notification that a flight is no longer applicable should the flight information change.
4.1	FF-ICE	3.3 Overall Collaborative Environment	It is expected that for making changes to information, access rights to each part of the flight information will be determined based upon the authority that each user has, given the state of the flight. Mechanisms will be in place (e.g., data “ownership”) to manage information updates from multiple authorized parties. User profiles will be applied to define default behavior for access, authorization, and subscription to information.
4.1	FF-ICE	3.3.1 Elts of the ICE	Participants are expected to provide and consume shared information, subject to tailored information requirements, to deliver the Concept component functionality.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
4.1	FF-ICE	3.3.1 Elts of the ICE	The airspace user is one participant that provides and updates flight information. It also receives or obtains ASP-issued modifications to that information. There will be requirements on the information that must be provided, and there may be requirements on aircraft performance/capabilities. The airspace user will be able to obtain these requirements and ensure compliance. In some areas, these requirements may be dynamic, with a correspondingly dynamic and automated mechanism for obtaining requirements.
4.1	FF-ICE	3.4 FF-ICE Timeline	Initial information provision may occur at any point along the timeline. For example, differing airspace users may have different planning horizons as described in Section 3.4.5. This initial information will be provided through a designated point-of-entry (POE, see Appendix H.1.5) and to an ASP typically applicable to the flight's departure point. Some ASPs may accommodate multiple POEs, and some ASPs may accommodate the receipt of initial flight information from POEs not explicitly associated with a flight's departure point. Clarity regarding responsibility for information is aided by information audit trails.
4.1	FF-ICE	3.4 FF-ICE Timeline	Requirements will be levied on participants to supply specific information by certain deadlines tied to events.
4.1	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace user-provided information is subject to change as information becomes known with greater certainty closer to departure. Operators providing this information are expected to update it as more accurate planning information becomes available.
4.1	FF-ICE	3.5.1 Scheduling and Strategic Activities	In a performance-based environment, certain regions will require more stringent information provision in order to achieve required performance levels. Airspace users will have access to these requirements and, based upon the flight being planned, additional information will be provided. This may include, among other things: · Aircraft type information for aerodrome gate planning · Aircraft wake performance for aerodrome capacity estimation · Navigation performance on departure or arrival at the requested aerodromes for capacity estimation · Environmental performance levels for environmental management · Achievable departure and arrival time performance Notified aerodromes and ASP use the provided information to conduct strategic DCB and related AOM activities to deliver capacity where required
4.1	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
4.1	Eng Needs	2.4 Discovery of Current and Evolving Future Requirements	2.4.2.1. Support the discovery of stakeholders' current and evolving flight data requirements
4.1	Eng Needs	2.4 Discovery of Current and Evolving Future Requirements	2.4.2.2 Enable all stakeholders to identify/select (discover) the flight data elements they require (and are authorized to receive)
4.2			**FO shall identify the flight data and data exchange services that are available to and/or are required from Airspace Users and provide mechanisms to make this descriptive information available.**

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
4.2	FF-ICE	2.1.1	Quality of Service Assessment - In some KPAs (efficiency, flexibility, predictability), performance is defined as the difference between the flight as flown and a certain baseline for the flight. What needs to be measured and managed are changes and trade-offs made during the (collaborative) planning process and the extent to which ATM can facilitate optimum flight operations as defined by the performance needs of each individual airspace user. In order to support these KPAs, the FF-ICE will need to enable archiving of a number of trajectory versions representing reference performance and the evolution of the plan as a result of the collaborative planning process.
4.2	FF-ICE	3.3.1 Elts of the ICE	The airspace user is one participant that provides and updates flight information. It also receives or obtains ASP-issued modifications to that information. There will be requirements on the information that must be provided, and there may be requirements on aircraft performance/capabilities. The airspace user will be able to obtain these requirements and ensure compliance. In some areas, these requirements may be dynamic, with a correspondingly dynamic and automated mechanism for obtaining requirements.
4.2	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs
4.2	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
4.2	FO ConOps	Section 1.2	Flight Object consumers must be able to seamlessly discover and integrate new or updated Data Elements.
4.3			**FO shall provide mechanisms by which all ATM participants can participate in identifying and developing new flight data and data exchanges as members of the CDM process.**
4.3	FF-ICE	2.3 – R16	Ensure that airspace users are included in all aspects of airspace management via the collaborative decision-making process
4.3	9854	Appendix D Expectations - Participation by the ATM community	The ATM community should have a continuous involvement in the planning, implementation and operation of the system to ensure that the evolution of the global ATM system meets the expectations of the community.
4.3	Eng Needs	2.4 Discovery of Current and Evolving Future Requirements	2.4.2.3 Enable all stakeholders to propose and participate in the introduction of new flight data elements and data classes

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
4.3	Eng Needs	2.4 Discovery of Current and Evolving Future Requirements	2.4.2.4 Support the discovery of current and future data exchange services
4.3	Eng Needs	2.4 Discovery of Current and Evolving Future Requirements	2.4.2.5 Support the discovery of stakeholders' evolving flight data requirements
4.3	FO ConOps	Section 1.2	Flight Object consumers must be able to seamlessly discover and integrate new or updated Data Elements.
4.3	FO ConOps	Section 1.2	The repository for the flight information (the harmonized and semantically complete set of Flight Data Elements) must allow addition of new or updated Data Elements easily.
5.1			**FO shall identify and support region-unique and region-to-region flight data and data interface requirements.**
5.1	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.
5.1	FF-ICE	3.3 Overall Collaborative Environment	Local design decisions may dictate that the underlying mechanisms for communicating flight information may not be identical; however, these mechanisms must be compatible across boundaries and capable of exchanging required information during all phases of flight planning.
5.1	FF-ICE	3.3 Overall Collaborative Environment	The FF-ICE will be based on a globally consistent and unambiguous set of information elements. Providing consistent information does not imply that information requirements will be identical globally.
5.1	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.
5.1	FF-ICE	3.3.1 Elts of the ICE	For performance reasons, different information elements will be required under different circumstances, locations, and times. The required set of information elements and conditions on providing information will be specified in requirements. Both global and regional requirements will exist. . As an example, one region may require airport slot information for coordinated airports at some time before estimated off block time (EOBT). A mechanism will be in place to ensure, through automated means, that information requirements are complied with. Compliance with requirements may be real-time (e.g., information item is provided by a specified time) or post-analysis (e.g., early intent information meets accuracy requirements).
5.1	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
5.1	FF-ICE	3.3.1 Elts of the ICE	Specifications on providing required information for the FF-ICE will also be expressed using aeronautical information. For example, levels of precision required for trajectory information provision can be dynamic and dependent on airspace constructs such as routing. Requirements may also vary regionally based upon circumstances and desired performance levels.
5.1	FF-ICE	3.5.1 Scheduling and Strategic Activities	In a performance-based environment, certain regions will require more stringent information provision in order to achieve required performance levels. Airspace users will have access to these requirements and, based upon the flight being planned, additional information will be provided. This may include, among other things: · Aircraft type information for aerodrome gate planning · Aircraft wake performance for aerodrome capacity estimation · Navigation performance on departure or arrival at the requested aerodromes for capacity estimation · Environmental performance levels for environmental management · Achievable departure and arrival time performance Notified aerodromes and ASP use the provided information to conduct strategic DCB and related AOM activities to deliver capacity where required
5.1	FF-ICE	5.1 Characteristics of Transition	Adjacent regions may operate with different types of FPLs (i.e., future versus present). Flights operating across these boundaries require the ability to provide flight information to both types of regions, and a mechanism must be defined for in-flight amendments across differing regions.
5.1	FF-ICE	5.1 Characteristics of Transition	During transition, a situation will have to be considered in which different regions are transitioning at different speeds, while maintaining operational service and making the best use of the FF-ICE aspects which they have implemented at each step.
5.1	FF-ICE	5.3 Information Access Requirements	The FF-ICE will consider requirements of member states regarding the need for information. Some of this information will have its access limited, and security measures will be in place to ensure that this access is strictly controlled. Additional security measures will likely be implemented for information confidentiality and integrity.
5.1	FF-ICE	5.6 Actual Transition Phase	Flights operating between regions where the present Flight Plan is used and regions using the FF-ICE will require that necessary information be passed through or around incompatible regions for transmission to the next.
5.1	FF-ICE	App B.1 Transition Steps - Step 1	Specifications will be needed for the (SWIM region-to-region) interface in order to ensure the required level of interoperability.
5.1	FF-ICE	App B.1 Transition Steps - Step 1	An end-to-end delivery assurance scheme will be required (for SWIM region-to-region interfaces), consistent with the level of criticality of applications using the provided data.
5.1	FF-ICE	App B.1 Transition Steps - Step 2	As soon as two regions have implemented the GUFI, the ASPs and other FF-ICE information users in those regions will be able to include it in any flight data which they may pass to each other concerning flights which fly through both regions.
5.1	FF-ICE	App B.2 Transition Scenarios	The anticipation that not all ASPs will transition to the FF-ICE at once will require a means for flight planning to continue during this period.
5.1	FF-ICE	App B.2 Transition Scenarios	For amendments initiated in a present-day FPL region, neighboring FF-ICE regions will likely have to be able to incorporate changes to the FPL data items into the FF-ICE. Similarly, changes initiated in an FF-ICE region can be transformed into the present-day FPL for transfer to adjacent FIRs operating present-day FPL systems.
5.1	Eng Needs	2.3 Flight Data Exchange Management	2.3.2.4 Provide support for localized documentation of services (e.g., service descriptions) and data element representations (e.g., unit of measure conversion, date/time format, support for non-Latin alphabets)

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
5.1	Eng Needs	2.7 Flight Data and Data Exchange Governance	2.7.2.3 Establish international agreement on flight data content and data exchanges between regions
5.2			**FO shall support the transition and evolution of the flight plan and flight-related messages.**
5.2	FF-ICE	2.2 Sharing Flight Information	The FF-ICE will replace all existing data message formats between ATM Community members about flight intent and flight progression.
5.2	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.
5.2	FF-ICE	4.1 Overview	The future flight information exchange mechanism must support a transition. During the transition period, present-day systems that employ current message formats and protocols and new systems that employ the new standard are expected to continue to interoperate.
5.2	FF-ICE	5.1 Characteristics of Transition	The FF-ICE will replace the present FPL as the single, global standardized message exchange process for FPL information.
5.2	FF-ICE	5.1 Characteristics of Transition	Adjacent regions may operate with different types of FPLs (i.e., future versus present). Flights operating across these boundaries require the ability to provide flight information to both types of regions, and a mechanism must be defined for in-flight amendments across differing regions.
5.2	FF-ICE	5.4 Impact on Other ATS Messages	Changes to the process for providing flight information will result in required changes to additional ATS Service messages. In particular, all messages which rely on data fields defined for the FPL will be impacted by changes to the data fields.
5.2	FF-ICE	5.4 Impact on Other ATS Messages	The multiple phases of the FF-ICE are expected to alter or remove the need for the various filed FPL update messages depending on implementation. The more dynamic and collaborative nature of flight information will require information be provided earlier and with more frequent updates with unambiguous reference to existing flight information
5.2	FF-ICE	5.4 Impact on Other ATS Messages	Coordination messages will be impacted by changes to the information format, exchange mechanisms, and the flight information process. The Global ATM Operational Concept and associated requirements indicate the need for shared common information. The process by which this information is shared will replace the current coordination messages
5.2	FF-ICE	5.5 User Interactions	During transition, global operators will likely interface with both present-day and future systems simultaneously.
5.2	FF-ICE	5.6 Actual Transition Phase	It is not expected that the transition to the FF-ICE will occur on a global scale all at once, and for this reason, operational compatibility between existing and future flight information is required. During this transition phase, processes must be in place to ensure that the required information for either the present Flight Plan or the new FF-ICE is provided to those ASPs using the applicable approach.
5.2	FF-ICE	5.6 Actual Transition Phase	Flights operating between regions where the present Flight Plan is used and regions using the FF-ICE will require that necessary information be passed through or around incompatible regions for transmission to the next.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
5.2	FF-ICE	App B.1 Transition Steps - Step 2	This (SWIM) architecture could facilitate the later steps by providing a 'converter' function between the FPL and FF-ICE information format and content.
5.2	FF-ICE	App B.1 Transition Steps - Step 2	In this step, even flight information entering the Air Traffic Management (ATM) System as an FPL would receive a GUFI generated according to an ICAO specification when accepted by the ATM network. The GUFI would be used in any further information sharing concerning the flights.
5.2	FF-ICE	App B.2 Transition Scenarios	It is assumed that there is an overlap in the information required for the FF-ICE compared to the present FPL
5.2	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.
5.2	FF-ICE	App B.2 Transition Scenarios	For amendments initiated in a present-day FPL region, neighboring FF-ICE regions will likely have to be able to incorporate changes to the FPL data items into the FF-ICE. Similarly, changes initiated in an FF-ICE region can be transformed into the present-day FPL for transfer to adjacent FIRs operating present-day FPL systems.
5.2	Eng Needs	2.5 Cross-Regional International Flight Data Content and Data Exchange Requirements	2.5.2.1 Support legacy data content and data exchange requirements
5.2	FO ConOps	Section 4.1	Implementation of FO capabilities will be incremental.
5.3			**FO shall support ATM operations during the transitional period during which ATM participants independently transition to full NextGen functionality.**
5.3	FF-ICE	2.2 Information Distribution	The FF-ICE concept recognizes that performance considerations may result in not everyone being able to participate at the same level of information sharing. Thus, for an extended time there will be "pockets" of SWIM capabilities. Consideration is given to how advanced SWIM capabilities can be maximized even with areas that have not yet enabled advanced SWIM capabilities.
5.3	FF-ICE	3.3 Overall Collaborative Environment	Local design decisions may dictate that the underlying mechanisms for communicating flight information may not be identical; however, these mechanisms must be compatible across boundaries and capable of exchanging required information during all phases of flight planning.
5.3	FF-ICE	4.1 Overview	The future flight information exchange mechanism must support a transition. During the transition period, present-day systems that employ current message formats and protocols and new systems that employ the new standard are expected to continue to interoperate.
5.3	FF-ICE	5.1 Characteristics of Transition	Not every participant in the ATM System will transition to the FF-ICE simultaneously although certain states and regions may be able to act cooperatively to make the transition together.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
5.3	FF-ICE	5.1 Characteristics of Transition	During transition, a situation will have to be considered in which different regions are transitioning at different speeds, while maintaining operational service and making the best use of the FF-ICE aspects which they have implemented at each step.
5.3	FF-ICE	5.4 Impact on Other ATS Messages	Changes to the process for providing flight information will result in required changes to additional ATS Service messages. In particular, all messages which rely on data fields defined for the FPL will be impacted by changes to the data fields.
5.3	FF-ICE	5.4 Impact on Other ATS Messages	The multiple phases of the FF-ICE are expected to alter or remove the need for the various filed FPL update messages depending on implementation. The more dynamic and collaborative nature of flight information will require information be provided earlier and with more frequent updates with unambiguous reference to existing flight information
5.3	FF-ICE	5.5 User Interactions	During transition, global operators will likely interface with both present-day and future systems simultaneously.
5.3	FF-ICE	App B.1 Transition Steps	In order to gain the maximum benefit of the transition steps as they are implemented, regions may be advised to follow a common transition plan.
5.3	FF-ICE	App B.1 Transition Steps - Step 2	This (SWIM) architecture could facilitate the later steps by providing a 'converter' function between the FPL and FF-ICE information format and content.
5.3	FF-ICE	App B.1 Transition Steps - Step 2	In this step, even flight information entering the Air Traffic Management (ATM) System as an FPL would receive a GUFI generated according to an ICAO specification when accepted by the ATM network. The GUFI would be used in any further information sharing concerning the flights.
5.3	FF-ICE	App B.2 Transition Scenarios	The anticipation that not all ASPs will transition to the FF-ICE at once will require a means for flight planning to continue during this period.
5.3	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.
5.3	FF-ICE	App B.2 Transition Scenarios	Transition Steps, the FF-ICE may be implemented in steps and partial functions may have to be supported during certain transition periods
5.3	Eng Needs	2.3 Flight Data Exchange Management	2.3.2.2 Support both legacy and evolving future NextGen processes and interfaces (e.g. CDM and SWIM)
5.3	Eng Needs	2.5 Cross-Regional International Flight Data Content and Data Exchange Requirements	2.5.2.2 Support evolving future data content and data exchange mechanisms requirements (driven by individual stakeholder transition plans and initiatives)
5.3	FO ConOps	Section 2.2	The FO will replace all existing data message formats between ATM Community members about flight intent and flight progress.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
5.3	FO ConOps	Section 4.1	Implementation of FO capabilities will be incremental.
5.4			**FO shall exploit and make best use of the NextGen functionality implemented at each transitional step.**
5.4	FF-ICE	2.2 Information Distribution	The FF-ICE concept recognizes that performance considerations may result in not everyone being able to participate at the same level of information sharing. Thus, for an extended time there will be “pockets” of SWIM capabilities. Consideration is given to how advanced SWIM capabilities can be maximized even with areas that have not yet enabled advanced SWIM capabilities.
5.4	FF-ICE	3.3 Overall Collaborative Environment	Local design decisions may dictate that the underlying mechanisms for communicating flight information may not be identical; however, these mechanisms must be compatible across boundaries and capable of exchanging required information during all phases of flight planning.
5.4	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
5.4	FF-ICE	5.1 Characteristics of Transition	There must be no reduction in safety during the transition period
5.4	FF-ICE	5.1 Characteristics of Transition	During transition, a situation will have to be considered in which different regions are transitioning at different speeds, while maintaining operational service and making the best use of the FF-ICE aspects which they have implemented at each step.
5.4	FF-ICE	5.4 Impact on Other ATS Messages	The multiple phases of the FF-ICE are expected to alter or remove the need for the various filed FPL update messages depending on implementation. The more dynamic and collaborative nature of flight information will require information be provided earlier and with more frequent updates with unambiguous reference to existing flight information
5.4	FF-ICE	App B.1 Transition Steps - Step 2	This (SWIM) architecture could facilitate the later steps by providing a ‘converter’ function between the FPL and FF-ICE information format and content.
5.4	FF-ICE	App B.1 Transition Steps - Step 2	In this step, even flight information entering the Air Traffic Management (ATM) System as an FPL would receive a GUFI generated according to an ICAO specification when accepted by the ATM network. The GUFI would be used in any further information sharing concerning the flights.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
5.4	FF-ICE	App B.2 Transition Scenarios	Transition Steps, the FF-ICE may be implemented in steps and partial functions may have to be supported during certain transition periods
5.4	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
5.4	9854	Appendix D Expectations - Participation by the ATM community	The ATM community should have a continuous involvement in the planning, implementation and operation of the system to ensure that the evolution of the global ATM system meets the expectations of the community.
5.4	9854	Appendix G EVOLUTION TO OPERATIONAL CONCEPT	1.6 The key issue is to eliminate, to the maximum extent possible, the need for duplication of ATM functionality within aircraft and/or ground systems. The solutions chosen by a State or region need not be technologically complex. Simple solutions, inter alia, changes to airspace organization and management, alignment of procedures, or strategic adjustment to flight schedules, may result in significant benefits for some States or regions. Others may require high levels of automation and technology.
6.1			**FO shall define and provide flight data and data exchange security in the multi-tiered heterogeneous operational ATM environment.**
6.1	FF-ICE	2.2 Information Security	Whether for commercial sensitivities or aviation security purposes, there is a need for increased information security. For example, an airline may be willing to share information with a service provider to permit an improved performance of the ATM System but would be unwilling for that same information to be available to an airline competitor. - The FF-ICE exchange mechanisms support layered information security
6.1	FF-ICE	3.1 Principles	Allow for the provision of information security requirements.
6.1	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
6.1	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
6.1	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
6.1	FF-ICE	4.4 Infrastructure	To fully protect the information during its lifetime, each component of the information processing system must have its own protection mechanisms by building up, layering on, and overlapping of security measures through a so-called defense-in-depth mechanism. The main layers of intervention are at network and data level.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
6.1	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of “denial of service” attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
6.1	FF-ICE	5.3 Information Access Requirements	The FF-ICE will consider requirements of member states regarding the need for information. Some of this information will have its access limited, and security measures will be in place to ensure that this access is strictly controlled. Additional security measures will likely be implemented for information confidentiality and integrity.
6.1	FF-ICE	5.5 User Interactions	The introduction of the FF-ICE will allow the provision of airspace user constraints, preferences, priorities, and other potentially proprietary information. Through information security, this FF-ICE information can be protected.
6.1	9854	Appendix D Expectations - Security	Security refers to the protection against threats that stem from intentional acts (e.g. terrorism) or unintentional acts (e.g. human error, natural disaster) affecting aircraft, people or installations on the ground. Adequate security is a major expectation of the ATM community and of citizens. The ATM system should therefore contribute to security, and the ATM system, as well as ATM-related information, should be protected against security threats. Security risk management should balance the needs of the members of the ATM community that require access to the system, with the need to protect the ATM system. In the event of threats to aircraft or threats using aircraft, ATM shall provide the authorities responsible with appropriate assistance and information.
6.1	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.2 Ensure adherence to established authorizations for providing flight data and de-confliction services when there are conflicting data updates
6.1	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.3 Ensure confidentiality (prevent disclosure of information to unauthorized stakeholders)
6.1	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.4 Ensure data integrity (trustworthiness of the system)

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
6.1	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.5 Prevent activities that reduce availability (e.g. denial-of-service attacks)
6.1	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.6 Ensure authenticity (that the flight data is genuine and that all stakeholders involved in a transaction are correctly identified)
6.1	Eng Needs	2.6 Flight Data Exchange Security	2.6.2.7 Ensure non-repudiation (prevent any stakeholder involved in a flight data transaction from denying having sent or received the flight data)
6.1	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.5 Ensure acceptable system security levels
6.1	FO ConOps	Section 2.5	The FO exchange mechanisms support layered information security.
7.1			**FO governance functions shall define and enable globally consistent standards-based flight data and data exchange mechanisms.**
7.1	FF-ICE	2.2 Information Distribution	In the end state, the FF-ICE provides a globally consistent mechanism and consistent interface for providing and receiving FF-ICE information.
7.1	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.
7.1	FF-ICE	2.2 Flexible Information Set	The FF-ICE supports unambiguous versioning of information with validation against a published standard. Changes to the FF-ICE can be specified in new versions of the standard while standard practices ensure that formats are adhered to. Backward compatibility between different versions allows interoperability between ATM Community members without requiring coordinated transitions.
7.1	FF-ICE	3.1 Principles	Provide a flexible concept that allows new technologies and procedures to be incorporated as necessary in a planned manner. This flexibility should also consider the effects of evolving information and communications standards.
7.1	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
7.1	FF-ICE	3.3 Overall Collaborative Environment	Local design decisions may dictate that the underlying mechanisms for communicating flight information may not be identical; however, these mechanisms must be compatible across boundaries and capable of exchanging required information during all phases of flight planning.
7.1	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.
7.1	FF-ICE	3.3 Overall Collaborative Environment	Information must be shared on a system-wide basis. (§2.9.5)
7.1	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
7.1	FF-ICE	4.2 Information Elements	One of these domain specific data models would consider all flight information. The flight information to be exchanged needs to be modeled explicitly to allow a precise and concrete definition to be agreed upon. The model needs to pick up the currently used flight information elements and expand them considerably to growing information needs. It needs to be consistent with work that has already defined some data models and the associated services within specific domains (e.g., Aeronautical Information).
7.1	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
7.1	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
7.1	9854	Appendix D Expectations - Global Interoperability	The ATM system should be based on global standards and uniform principles to ensure the technical and operational interoperability of ATM systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.
7.1	9854	Appendix F ATM System Performance	2.2.3 c) where a change to a system implies a departure from “currently approved operational boundaries”, it will not be possible to determine a priori, without analysis, whether it will impact safety or not. Therefore, for any change, a clearly defined and explicit change management process will be used, supported by a safety case or equivalent, including the analysis of all the necessary routine and foreseeable emergency configurations;
7.1	Eng Needs	2.7 Flight Data and Data Exchange Governance	2.7.2.2 Set acceptable, and agreed to, quality of service and performance levels
7.1	Eng Needs	2.11 Data Exchange System and Network Management	2.11.2.5 Support distributed and loosely coupled management structures in which multiple authorities control their respective domains
7.1	FO ConOps	Section 1.4	FIXM has been identified as the data standard to be used by the FAA to exchange FO data within the NAS and between the FAA and other ANSPs. FIXM will standardize current and future elements to increase interoperability and data exchange between systems that require FO information.
7.2			**FO shall develop and maintain appropriate management, secretariat facilitation support, and processes during the evolution to full NextGen functionality.**
7.2	FF-ICE	2.2 Advance Notification	Mandatory requirements for data and requirements for submission are balanced to enhance flexibility and ensure reliability of information—however, airspace users will be encouraged to supply information as soon as it becomes reliable enough to be useful to assist in ATM planning. Service providers will be reminded to consider all performance areas, including flexibility to accommodate infrequent subsequent changes that appear to be in good faith.
7.2	FF-ICE	2.2 Flexible Information Set	Attempts to accommodate changing information needs at global, regional, and state levels resulted in use of ICAO Flight Plan Item 18 that were inefficient. There were problems with inconsistent requirements, lack of global definitions, problems with automation processing, etc. There needs to be flexibility so that new data elements can be included and information no longer relevant deleted. Inefficient constraints, such as fixed data lengths or free text information, should be minimized. A concept that ensures that updates to flight information formats are done in a globally efficient manner is required.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
7.2	FF-ICE	2.2 Flexible Information Set	The FF-ICE supports unambiguous versioning of information with validation against a published standard. Changes to the FF-ICE can be specified in new versions of the standard while standard practices ensure that formats are adhered to. Backward compatibility between different versions allows interoperability between ATM Community members without requiring coordinated transitions.
7.2	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
7.2	FF-ICE	3.1 Principles	Avoid unnecessary limitations on information.
7.2	FF-ICE	3.1 Principles	Consider the cost impact on providers and consumers of flight information.
7.2	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.
7.2	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
7.2	FF-ICE	5.5 User Interactions	The introduction of the FF-ICE will allow the provision of airspace user constraints, preferences, priorities, and other potentially proprietary information. Through information security, this FF-ICE information can be protected.
7.2	9854	2.9 Information Services	2.9.4 Information management will contribute to meeting the expectations of the ATM community through all operational services. Its more direct contribution to improvements in the ATM system will be in the quality of the information that will, in turn, provide significant additional benefits. In particular, the wide availability of high-quality, relevant aeronautical data presented to all airspace users in a usable format will contribute to increased aviation safety.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
7.2	9854	2.9 Information Services - Temporality and Issuance	2.9.13 The temporality of the information depends on its nature. Some data can be prepared in advance and are valid for a rather long period; other data change in real time and are obsolete immediately. As a principle, any valid and relevant information will be made available as soon as it becomes available.
7.2	9854	Appendix D Expectations - Access and equity	The global ATM system should ensure equity for all users that have access to a given airspace or service. Generally, the first aircraft ready to use the ATM resources will receive priority, except where significant overall safety or system operational efficiency would accrue or national defense considerations or interests dictate that priority be determined on a different basis.
7.2	9854	Appendix D Expectations - Safety	Safety is the highest priority in aviation, and ATM plays an important part in ensuring overall aviation safety. Uniform safety standards and risk and safety management practices should be applied systematically to the ATM system. In implementing elements of the global aviation system, safety needs to be assessed against appropriate criteria and in accordance with appropriate and globally standardized safety management processes and practices.
7.2	Eng Needs	2.7 Flight Data and Data Exchange Governance	2.7.2.1 Define change management processes for data content and data exchanges (possibly via a Change Control Board-like mechanism)
7.2	Eng Needs	2.7 Flight Data and Data Exchange Governance	2.7.2.4 Establish versioning policies for data content, data models, data structures, and data exchanges
7.2	FO ConOps	Section 2.6	The FO supports unambiguous versioning of information with validation against a published standard. Changes to the FO can be specified in new versions of the technical standards while standard practices ensure that formats are followed. Backward compatibility between different versions allows interoperability between ATM Community members without requiring coordinated transitions.
8.1			**FO shall devise, document and support development of appropriate touch-points and interactions with the aeronautical and other NextGen domains.**
8.1	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs
8.1	FF-ICE	3.3.1 Elts of the ICE	Flight information will refer to aeronautical information (e.g., this could be expressed in Aeronautical Information Exchange Model [AIXM] format). This includes static information such as runways, airports, and fixed boundaries. Aeronautical information can also be dynamic as described below. In the far-term, it is expected that all aeronautical information will be managed to support dynamic data.
8.1	FF-ICE	3.3.1 Elts of the ICE	AOM allows the dynamic definition of airspace constructs such as airspace volumes and routes. This will be dynamically reflected in aeronautical information. These must be shared in such a way that flight information can reference the dynamic data and verify that flights meet required constraints.
8.1	FF-ICE	3.3.1 Elts of the ICE	Specifications on providing required information for the FF-ICE will also be expressed using aeronautical information. For example, levels of precision required for trajectory information provision can be dynamic and dependent on airspace constructs such as routing. Requirements may also vary regionally based upon circumstances and desired performance levels.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
8.1	FF-ICE	3.3.1 Elts of the ICE	Separation provision activities will be conducted by the designated separator, which may be an ASP or the airspace user. In a trajectory-based environment, this activity operates on the 4D trajectory supplied as part of flight information, supplemented with up-to-date surveillance information. Separation provision must also consider the overall ATM situation, including dynamical aeronautical information, weather, and infrastructure status as shown in Figure 3.3-5.
8.1	FF-ICE	3.4 FF-ICE Timeline	Since the flight information process is expected to be ongoing, requirements for the provision of information will be event-driven. These can include certain events such as: the availability of a significant piece of data such as weather, a fixed time before scheduled pushback, a time prior to entry into airspace, the issuance of a clearance, or a change in responsibility. One example of an information provision requirement would be that before departure, the airspace user shall supply information necessary for the provision of emergency services.
8.1	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
8.1	FF-ICE	4.2 Information Elements	One of these domain specific data models would consider all flight information. The flight information to be exchanged needs to be modeled explicitly to allow a precise and concrete definition to be agreed upon. The model needs to pick up the currently used flight information elements and expand them considerably to growing information needs. It needs to be consistent with work that has already defined some data models and the associated services within specific domains (e.g., Aeronautical Information).
8.1	9854	2.9 Information Services	2.9.4 Information management will contribute to meeting the expectations of the ATM community through all operational services. Its more direct contribution to improvements in the ATM system will be in the quality of the information that will, in turn, provide significant additional benefits. In particular, the wide availability of high-quality, relevant aeronautical data presented to all airspace users in a usable format will contribute to increased aviation safety.
8.1	9854	2.9 Information Services - Media	2.9.15 The reference medium for aeronautical data will be a fully electronic and networked environment, with printouts used only as needed for reference, temporary memorization and visualization support to human operators.
8.2			**FO data shall be linked to and compatible with the NAS Enterprise Architecture.**
8.2	FF-ICE	4.1 Overview	SWIM—integrating all relevant ATM data—will form the basis for information management of the entire ATM System and will be essential for its efficient operation.
8.2	FF-ICE	4.2 Information Elements	One of these domain specific data models would consider all flight information. The flight information to be exchanged needs to be modeled explicitly to allow a precise and concrete definition to be agreed upon. The model needs to pick up the currently used flight information elements and expand them considerably to growing information needs. It needs to be consistent with work that has already defined some data models and the associated services within specific domains (e.g., Aeronautical Information).

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
8.2	FF-ICE	4.3 System-Wide Information Management	SWIM is supported by a suitable architecture allowing exchange of data and ATM services across the whole ATM System.
8.2	Eng Needs	2.8 System Engineering Products	2.8.2.3 Define high level system architecture for flight data exchanges
8.3			**FO shall ensure that flight data and data interfaces address and support safety considerations.**
8.3	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
8.3	FF-ICE	5.1 Characteristics of Transition	There must be no reduction in safety during the transition period
8.3	9854	2.9 Information Services - other essential services	2.9.20 (c) Aviation accident/incident investigation authorities will need to exploit recordings of flight trajectory data and ATM actions.
8.3	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
8.3	9854	Appendix D Expectations - Safety	Safety is the highest priority in aviation, and ATM plays an important part in ensuring overall aviation safety. Uniform safety standards and risk and safety management practices should be applied systematically to the ATM system. In implementing elements of the global aviation system, safety needs to be assessed against appropriate criteria and in accordance with appropriate and globally standardized safety management processes and practices.
8.3	9854	Appendix F ATM System Performance	2.2.3 b) each element of the ATM system, wherever implemented (aircraft, ground, space, etc.), will be subject to specific safety analysis, as an individual element and as a component of the larger integrated system. The implementation of any element of the system will be subject to appropriate safety assurance processes;
8.3	9854	Appendix F ATM System Performance	2.2.3 c) where a change to a system implies a departure from “currently approved operational boundaries”, it will not be possible to determine a priori, without analysis, whether it will impact safety or not. Therefore, for any change, a clearly defined and explicit change management process will be used, supported by a safety case or equivalent, including the analysis of all the necessary routine and foreseeable emergency configurations;
8.3	Eng Needs	2.8 System Engineering Products	2.8.2.2 Generate high level systems requirements for data content and data exchanges
8.4			**FO shall enhance the consistent, effective, and efficient use of flight data and data interfaces.**
8.4	FF-ICE	3.1 Principles	Avoid the filing of unnecessary and unambiguously derivable information. Adopt a “file-by-exception” philosophy when information can be standardized.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
8.4	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
8.4	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.
8.4	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
8.4	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
8.4	9854	Appendix D Expectations - Predictability	Predictability refers to the ability of airspace users and ATM service providers to provide consistent and dependable levels of performance.
8.4	9854	Appendix G EVOLUTION TO OPERATIONAL CONCEPT	1.6 The key issue is to eliminate, to the maximum extent possible, the need for duplication of ATM functionality within aircraft and/or ground systems. The solutions chosen by a State or region need not be technologically complex. Simple solutions, inter alia, changes to airspace organization and management, alignment of procedures, or strategic adjustment to flight schedules, may result in significant benefits for some States or regions. Others may require high levels of automation and technology.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.1			**FO shall ensure that flight data is exchanged with the required timeliness needed to support ATM operations and participants' requirements.**
9.1	FF-ICE	2.3 – R13	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
9.1	FF-ICE	3.3 Overall Collaborative Environment	Pertinent information will be available when and where it is required. (§2.9.6)
9.1	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.
9.1	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
9.1	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.
9.1	9854	2.9 Information Services	2.9.4 Information management will contribute to meeting the expectations of the ATM community through all operational services. Its more direct contribution to improvements in the ATM system will be in the quality of the information that will, in turn, provide significant additional benefits. In particular, the wide availability of high-quality, relevant aeronautical data presented to all airspace users in a usable format will contribute to increased aviation safety.
9.1	9854	2.9 Information Services	2.9.6 For the ATM system to operate at its full potential, pertinent information will be available when and where required.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.1	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
9.1	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.6 Ensure that flight data is available when it is needed (data availability)
9.2			**FO shall identify and support efforts to define, regularly review, and monitor performance for individual flights and the ATM system.**
9.2	FF-ICE	2.1	Ensure that performance targets are defined, regularly reviewed, and monitored;
9.2	FF-ICE	2.1.1	Quality of Service Assessment - In some KPAs (efficiency, flexibility, predictability), performance is defined as the difference between the flight as flown and a certain baseline for the flight. What needs to be measured and managed are changes and trade-offs made during the (collaborative) planning process and the extent to which ATM can facilitate optimum flight operations as defined by the performance needs of each individual airspace user. In order to support these KPAs, the FF-ICE will need to enable archiving of a number of trajectory versions representing reference performance and the evolution of the plan as a result of the collaborative planning process.
9.2	FF-ICE	2.1.1	End-to-end Performance Assessment - Performance of the ATM System is characterized by many dependencies. The FF-ICE provides mechanisms to have a single consistent set of information pertaining to each flight from which end-to-end performance can be obtained.
9.2	FF-ICE	2.2 Advance Notification	Mandatory requirements for data and requirements for submission are balanced to enhance flexibility and ensure reliability of information—however, airspace users will be encouraged to supply information as soon as it becomes reliable enough to be useful to assist in ATM planning. Service providers will be reminded to consider all performance areas, including flexibility to accommodate infrequent subsequent changes that appear to be in good faith.
9.2	FF-ICE	2.2 Information Distribution	The FF-ICE concept recognizes that performance considerations may result in not everyone being able to participate at the same level of information sharing. Thus, for an extended time there will be “pockets” of SWIM capabilities. Consideration is given to how advanced SWIM capabilities can be maximized even with areas that have not yet enabled advanced SWIM capabilities.
9.2	FF-ICE	2.3 – R13	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
9.2	FF-ICE	2.3 – R62	Select the applicable separation modes and separation minima for CM that best meet the ATM System performance targets

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.2	FF-ICE	3.1 Principles	Ensure that definitions of information elements for the FF-ICE are globally standardized. Regional variation required for performance reasons will be implemented by use of different subsets of the standard information elements. New elements will be introduced regionally through regional extensions as needed but will not be mandatory for other regions, will not provide duplicate information of existing elements, and should be intended to become part of the global standard. A formal process will be introduced for migrating successful new elements into the standard.
9.2	FF-ICE	3.3.1 Elts of the ICE	Flight and flow information must interact with aeronautical information to deliver certain services required by multiple members of the ATM Community. Not all services will be required by all members of the ATM Community and all services will not be provided by all ASPs
9.2	FF-ICE	3.5.1 Scheduling and Strategic Activities	In a performance-based environment, certain regions will require more stringent information provision in order to achieve required performance levels. Airspace users will have access to these requirements and, based upon the flight being planned, additional information will be provided. This may include, among other things: · Aircraft type information for aerodrome gate planning · Aircraft wake performance for aerodrome capacity estimation · Navigation performance on departure or arrival at the requested aerodromes for capacity estimation · Environmental performance levels for environmental management · Achievable departure and arrival time performance Notified aerodromes and ASP use the provided information to conduct strategic DCB and related AOM activities to deliver capacity where required
9.2	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
9.2	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.2	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
9.2	FF-ICE	App C.1 meeting (operational Scenarios) requirements	The operational scenarios described in this appendix indicate that ASPs will verify compliance with requirements. This term may refer to several types of dynamic requirements imposed on a flight and the information provided. • Syntax – Format for FF-ICE information items is expected to comply with a standard that can be automatically checked for validity through automation. The approach will comply with industry standards and provide flexibility through versioning. Standards will be defined at a global level but accommodate regional extensions. • Content – Requirements may be specified regarding what information items must be provided at a certain point in the time evolution of a flight. (For example, ATM System performance may dictate the need for flight schedule information three months before estimated off block time [EOBT] for flights operating to a specific destination airport.) • Performance – Constraints on required performance levels may be imposed on flights based upon where/when they are operating. These constraints may be in such areas as navigation (e.g., RNP level) or environmental (e.g., noise) performance. • Accuracy – FF-ICE information may have to be specified to a given level of accuracy and reliability. • Access Permissions – Airspace users may require permission for access. • Operational constraints – Additional requirements on flight information may include necessary operational constraints on a flight's trajectory.
9.2	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.
9.2	9854	2.9 Information Services	2.9.4 Information management will contribute to meeting the expectations of the ATM community through all operational services. Its more direct contribution to improvements in the ATM system will be in the quality of the information that will, in turn, provide significant additional benefits. In particular, the wide availability of high-quality, relevant aeronautical data presented to all airspace users in a usable format will contribute to increased aviation safety.
9.2	9854	2.9 Information Services	2.9.6 For the ATM system to operate at its full potential, pertinent information will be available when and where required.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.2	9854	Appendix D Expectations - Predictability	Predictability refers to the ability of airspace users and ATM service providers to provide consistent and dependable levels of performance.
9.2	Eng Needs	2.7 Flight Data and Data Exchange Governance	2.7.2.2 Set acceptable, and agreed to, quality of service and performance levels
9.2	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.3 Enable performance measurement
9.3			**FO shall provide mechanisms for flight data exchange that enables support of the defined and agreed quality of service (to include data-associated security, latency, risk management, and reliability).**
9.3	FF-ICE	2.1.1	Quality of Service Assessment - In some KPAs (efficiency, flexibility, predictability), performance is defined as the difference between the flight as flown and a certain baseline for the flight. What needs to be measured and managed are changes and trade-offs made during the (collaborative) planning process and the extent to which ATM can facilitate optimum flight operations as defined by the performance needs of each individual airspace user. In order to support these KPAs, the FF-ICE will need to enable archiving of a number of trajectory versions representing reference performance and the evolution of the plan as a result of the collaborative planning process.
9.3	FF-ICE	2.2 Derivable Information	The FF-ICE supports the provision of information services to ensure consistency of derived information.
9.3	FF-ICE	3.1 Principles	Incorporate requirements enabling a broad set of flight mission profiles.
9.3	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.
9.3	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.3	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
9.3	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.
9.3	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.
9.3	9854	2.9 Information Services	2.9.6 For the ATM system to operate at its full potential, pertinent information will be available when and where required.
9.3	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
9.3	9854	Appendix D Expectations - Predictability	Predictability refers to the ability of airspace users and ATM service providers to provide consistent and dependable levels of performance.
9.3	Eng Needs	2.7 Flight Data and Data Exchange Governance	2.7.2.2 Set acceptable, and agreed to, quality of service and performance levels
9.3	Eng Needs	2.3 Flight Data Exchange Management	2.3.2.3 Abide by agreed to quality of service levels for data exchange and establish, where appropriate, service level agreements
9.3	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.1 Achieve accepted quality of service levels for all supported data interactions
9.3	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.2 Ensure achievement of accepted risk management strategies

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.3	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2.4 Implement failure avoidance (e.g. graceful degradation of service) strategies
9.4			**FO shall enable and support desired ATM system adaptability and scalability levels.**
9.4	FF-ICE	3.1 Principles	Incorporate requirements enabling a broad set of flight mission profiles.
9.4	FF-ICE	4.1 Overview	SWIM—integrating all relevant ATM data—will form the basis for information management of the entire ATM System and will be essential for its efficient operation.
9.4	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.
9.4	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
9.4	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
9.4	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.4	9854	2.9 Information Services	2.9.7 ATM data has temporality and will change over time, but to varying degrees in terms of frequency or magnitude, varying from almost static to very dynamic. Information management will recognize and accommodate this temporality of data. This will impact the organization and issuance of data.
9.4	9854	2.9 Information Services	2.9.10 Information management will achieve a seamless transfer of relevant information between parties in a flexible, adaptable and scalable information environment.
9.4	9854	2.9 Information Services - Temporality and Issuance	2.9.13 The temporality of the information depends on its nature. Some data can be prepared in advance and are valid for a rather long period; other data change in real time and are obsolete immediately. As a principle, any valid and relevant information will be made available as soon as it becomes available.
9.4	9854	Appendix D Expectations - Access and equity	A global ATM system should provide an operating environment that ensures that all airspace users have right of access to the ATM resources needed to meet their specific operational requirements and that the shared use of airspace by different users can be achieved safely.
9.4	9854	Appendix D Expectations - Predictability	Predictability refers to the ability of airspace users and ATM service providers to provide consistent and dependable levels of performance.
9.4	9854	Appendix G EVOLUTION TO OPERATIONAL CONCEPT	1.2 The operational concept is adaptable to the operational environment of all States or regions by being scalable to meet their specific needs. One State or region, or a specific area or location within a State, may have an immediate imperative to improve safety, while another State or region may have an immediate imperative to improve efficiency.
9.4	Eng Needs	2.9 Flight Data Content and Data Exchanges Performance	2.9.2. 7 Ensure scalability both vertically (increase in the number of stakeholders) and horizontally (increase in the amount of data produced/consumed by each stakeholder)
9.5			**FO shall ensure that required flight information is available for all phases of the flight life cycle.**
9.5	FF-ICE	2.3 – R13	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
9.5	FF-ICE	3.3 Overall Collaborative Environment	Pertinent information will be available when and where it is required. (§2.9.6)
9.5	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.5	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
9.5	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of “denial of service” attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
9.5	9854	2.9 Information Services	2.9.6 For the ATM system to operate at its full potential, pertinent information will be available when and where required.
9.5	9854	2.9 Information Services - Temporality and Issuance	2.9.13 The temporality of the information depends on its nature. Some data can be prepared in advance and are valid for a rather long period; other data change in real time and are obsolete immediately. As a principle, any valid and relevant information will be made available as soon as it becomes available.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.5	9854	Appendix F ATM System Performance	2.2.3 c) where a change to a system implies a departure from “currently approved operational boundaries”, it will not be possible to determine a priori, without analysis, whether it will impact safety or not. Therefore, for any change, a clearly defined and explicit change management process will be used, supported by a safety case or equivalent, including the analysis of all the necessary routine and foreseeable emergency configurations;
9.6			**FO shall identify, enable, and support efforts to monitor and ensure flight data quality and data integrity.**
9.6	FF-ICE	2.1.1	Quality of Service Assessment - In some KPAs (efficiency, flexibility, predictability), performance is defined as the difference between the flight as flown and a certain baseline for the flight. What needs to be measured and managed are changes and trade-offs made during the (collaborative) planning process and the extent to which ATM can facilitate optimum flight operations as defined by the performance needs of each individual airspace user. In order to support these KPAs, the FF-ICE will need to enable archiving of a number of trajectory versions representing reference performance and the evolution of the plan as a result of the collaborative planning process.
9.6	FF-ICE	2.3 – R13	Ensure mutual exchange of relevant and timely data: — for the benefit of situational awareness; — for conflict-free trajectory management; and — to allow CDM concerning consequences of airspace user system design changes
9.6	FF-ICE	3.3 Overall Collaborative Environment	Information may be personalized, filtered, and accessed, as needed. The initial quality of the information will be the responsibility of the originator; subsequent handling will not compromise its quality. (§2.9.8)
9.6	FF-ICE	4.1 Overview	SWIM—integrating all relevant ATM data—will form the basis for information management of the entire ATM System and will be essential for its efficient operation.
9.6	FF-ICE	4.1 Overview	Sharing information of the required quality and timeliness in a secure environment is an essential enabler to the FF-ICE concept. The scope extends to all flight information that is of potential interest to ATM, especially various trajectories data.
9.6	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.6	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
9.6	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of “denial of service” attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
9.6	9854	2.9 Information Services	2.9.2 Information management provides accredited, quality-assured and timely information used to support ATM operations. Information management will also monitor and control the quality of the shared information and provide information-sharing mechanisms that support the ATM community.
9.6	9854	2.9 Information Services	2.9.4 Information management will contribute to meeting the expectations of the ATM community through all operational services. Its more direct contribution to improvements in the ATM system will be in the quality of the information that will, in turn, provide significant additional benefits. In particular, the wide availability of high-quality, relevant aeronautical data presented to all airspace users in a usable format will contribute to increased aviation safety.
9.6	9854	2.9 Information Services	2.9.8 Information may be personalized, filtered and accessed as needed. The initial quality of the information provided will be the responsibility of the originator; subsequent handling will not compromise its quality.
9.7			**FO shall identify, enable, and support efforts to monitor and ensure data reliability and compliance with flight data requirements.**

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
9.7	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.
9.7	FF-ICE	3.3 Overall Collaborative Environment	Pertinent information will be available when and where it is required. (§2.9.6)
9.7	FF-ICE	3.4 FF-ICE Timeline	Throughout the flight information process, various participants will interact with the FF-ICE. These will change along the flight information provision timeline with more strategic functions (DCB) being involved earlier and more tactical functions (e.g., TS and CM) later.
9.7	FF-ICE	4.2 Information Elements	FF-ICE contains information necessary for the notifying, managing, and coordinating flights between members of the ATM Community.
9.7	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
9.7	FF-ICE	App C.1 meeting (operational Scenarios) requirements	The operational scenarios described in this appendix indicate that ASPs will verify compliance with requirements. This term may refer to several types of dynamic requirements imposed on a flight and the information provided. • Syntax – Format for FF-ICE information items is expected to comply with a standard that can be automatically checked for validity through automation. The approach will comply with industry standards and provide flexibility through versioning. Standards will be defined at a global level but accommodate regional extensions. • Content – Requirements may be specified regarding what information items must be provided at a certain point in the time evolution of a flight. (For example, ATM System performance may dictate the need for flight schedule information three months before estimated off block time [EOBT] for flights operating to a specific destination airport.) • Performance – Constraints on required performance levels may be imposed on flights based upon where/when they are operating. These constraints may be in such areas as navigation (e.g., RNP level) or environmental (e.g., noise) performance. • Accuracy – FF-ICE information may have to be specified to a given level of accuracy and reliability. • Access Permissions – Airspace users may require permission for access. • Operational constraints – Additional requirements on flight information may include necessary operational constraints on a flight's trajectory.
10.1			**FO shall provide and support robust applications to ease parsing and displaying pertinent information.**
10.1	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
10.1	FF-ICE	4.1 Overview	Increasing the amount of flight data exchanged may result in a format that is not easily human readable. However, robust applications can be developed to ease parsing and displaying pertinent information, as desired.
10.1	FF-ICE	4.4.2.2 Security	System wide security management functions (e.g., access control, network management) will be integrated and will meet the broadly accepted information system security needs: Identification: The recipient of information needs to determine the identity of the sender. Information received may be a request for services or information related to the FPL. Authentication: The recipient of information must ensure that the identity of the sender is valid. Authorization: The recipient must determine the level of access granted to an authenticated second party. This access is for providing or receiving data or services. Integrity: Transmitted data must remain unaltered until final delivery. Confidentiality: Transmitted data must not be viewed by unauthorized entities. Availability: While not exclusively a security concern, the introduction of "denial of service" attacks makes some aspects of availability a security issue. Availability ensures that FPL information and services can be accessed when required. The security component deals with availability as a result of deliberate actions (versus system malfunction) to deny availability. Accountability: Authorities must be able to determine the actions of the interacting agents and to identify the agents. Audit trails support accountability.
10.1	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually "unlimited" access to information with "limited" bandwidth, and optimize the transfer of information.
10.1	9854	2.9 Information Services - Media	2.9.15 The reference medium for aeronautical data will be a fully electronic and networked environment, with printouts used only as needed for reference, temporary memorization and visualization support to human operators.
10.2			**FO shall support and promote use of standardized and open source software tools.**
10.2	FF-ICE	3.1 Principles	Provide a flexible concept that allows new technologies and procedures to be incorporated as necessary in a planned manner. This flexibility should also consider the effects of evolving information and communications standards.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
10.2	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
10.2	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
10.2	9854	Appendix D Expectations - Global Interoperability	The ATM system should be based on global standards and uniform principles to ensure the technical and operational interoperability of ATM systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.
10.2	Eng Needs	2.10 Data Exchange Software Engineering	2.10.2.1 Support and promote the use of standardized software development processes
10.2	Eng Needs	2.10 Data Exchange Software Engineering	2.10.2.2 Support and promote the use of standardized software solutions (e.g., web services)
10.2	Eng Needs	2.10 Data Exchange Software Engineering	2.10.2.3 Support and promote open source tools, standards, and solutions
11.1			**FO shall enable and support an end-to-end flight data delivery assurance scheme for SWIM region-to-region and ATM participant-to-ATM participant interfaces.**
11.1	FF-ICE	3.3 Overall Collaborative Environment	While the definition of flight information will be standardized globally, the FF-ICE will contain some data elements that are required in one region and not in others. Practically, this implies a need for an infrastructure to support the transport of this information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
11.1	FF-ICE	3.3 Overall Collaborative Environment	Pertinent information will be available when and where it is required. (§2.9.6)
11.1	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
11.1	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
11.1	FF-ICE	App B.1 Transition Steps - Step 1	An end-to-end delivery assurance scheme will be required (for SWIM region-to-region interfaces), consistent with the level of criticality of applications using the provided data.
11.1	FF-ICE	App B.2 Transition Scenarios	The interaction between aircraft operators and ASPs can potentially fall into several categories: • An FF-ICE-enabled ASP may require operators to provide FF-ICE information • An FF-ICE-enabled ASP may allow both present-day FPL filing and FF-ICE information provision for some transition period. Improved service levels may be provided to operators providing the FF-ICE. • An ASP operating with a present-day FPL may only accept the present-day FPL • An ASP operating with a present-day FPL may choose to accept a FF-ICE but operate internally as if an FPL was received.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
11.1	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
11.2			**FO shall identify, enable and support the establishment and sharing of the archived flight data needed for trend analysis, validation, forecasting, and modeling.**
11.2	FF-ICE	2.1	Ensure that all information for performance management is available and transparent to the concerned parties and that information disclosure rules are in place
11.2	FF-ICE	2.1.1	Long-term performance management looks ahead many years to set feasible objectives and targets and anticipate levels of performance. Where necessary, evidence-based, planned improvements are proposed to meet targets. The FF-ICE information supports this activity by providing archived data that can be used for such functions as trend analysis, validation, forecasting, and model improvement.
11.2	FF-ICE	2.1.1	Quality of Service Assessment - In some KPAs (efficiency, flexibility, predictability), performance is defined as the difference between the flight as flown and a certain baseline for the flight. What needs to be measured and managed are changes and trade-offs made during the (collaborative) planning process and the extent to which ATM can facilitate optimum flight operations as defined by the performance needs of each individual airspace user. In order to support these KPAs, the FF-ICE will need to enable archiving of a number of trajectory versions representing reference performance and the evolution of the plan as a result of the collaborative planning process.
11.2	FF-ICE	2.2 Sharing Flight Information	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
11.2	FF-ICE	2.3 – R36	a) Utilize historical and forecast weather information, including seasonal patterns and major weather phenomena; b) Use information on changes in infrastructure status to increase predictability and maximize capacity utilization to meet performance targets; c) Ensure collaboration on post-event analysis to support strategic planning; d) Utilize projected traffic demand and planned trajectories; e) Accommodate revisions to trajectory requests and resource status; f) Ensure collaboration on projections and responses; g) Facilitate collaboration on trajectory changes and traffic demands
11.2	9854	2.9 Information Services	2.9.3 Information management will assemble the best possible integrated picture of the historical, real-time and planned or foreseen future state of the ATM situation. Information management will provide the basis for improved decision making by all ATM community members. Key to the concept will be the management of an information-rich environment.
11.2	9854	Appendix F ATM System Performance	2.2.3 c) where a change to a system implies a departure from “currently approved operational boundaries”, it will not be possible to determine a priori, without analysis, whether it will impact safety or not. Therefore, for any change, a clearly defined and explicit change management process will be used, supported by a safety case or equivalent, including the analysis of all the necessary routine and foreseeable emergency configurations;

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
11.2	Eng Needs	2.1 Accurate and Complete Data	2.1.2.2 Define flight data retention and archive requirements
11.2	Eng Needs	2.11 Data Exchange System and Network Management	2.11.2.3 Support establishment of standardized flight data archival mechanisms
11.2	FO ConOps	Section 2.2	The information about the flight will be available from the time of first notification of the flight intent until after the flight has completed, at which time the information will be archived.
11.3			**FO shall provide or support mechanisms that enable increased flight data sharing among the different authorized ATM participants for each flight life cycle phase.**
11.3	FF-ICE	2.1.1	Quality of Service Assessment - In some KPAs (efficiency, flexibility, predictability), performance is defined as the difference between the flight as flown and a certain baseline for the flight. What needs to be measured and managed are changes and trade-offs made during the (collaborative) planning process and the extent to which ATM can facilitate optimum flight operations as defined by the performance needs of each individual airspace user. In order to support these KPAs, the FF-ICE will need to enable archiving of a number of trajectory versions representing reference performance and the evolution of the plan as a result of the collaborative planning process.
11.3	FF-ICE	3.3 Overall Collaborative Environment	Pertinent information will be available when and where it is required. (§2.9.6)
11.3	FF-ICE	3.4 FF-ICE Timeline	Whereas currently an aircraft operator may file a single FPL form, in the future, the operator will provide increasing information about a flight as time approaches departure and throughout the flight. Some of this information is known ahead of time with relative certainty (e.g., departure and arrival airport), other information will be better known closer to departure (e.g., route of flight, estimated time en-route), and some could change dynamically throughout the flight (e.g., estimated time of departure, agreed trajectory).
11.3	FF-ICE	3.4 FF-ICE Timeline	Throughout the flight information process, various participants will interact with the FF-ICE. These will change along the flight information provision timeline with more strategic functions (DCB) being involved earlier and more tactical functions (e.g., TS and CM) later.
11.3	FF-ICE	3.4 FF-ICE Timeline	Initial information provision may occur at any point along the timeline. For example, differing airspace users may have different planning horizons as described in Section 3.4.5. This initial information will be provided through a designated point-of-entry (POE, see Appendix H.1.5) and to an ASP typically applicable to the flight's departure point. Some ASPs may accommodate multiple POEs, and some ASPs may accommodate the receipt of initial flight information from POEs not explicitly associated with a flight's departure point. Clarity regarding responsibility for information is aided by information audit trails.
11.3	FF-ICE	3.4.1 Scheduling and Strategic Activities	Airspace users may wish to provide information for flights which will operate in the same manner on a repeated basis. This is acceptable

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
11.3	FF-ICE	3.4.1 Scheduling and Strategic Activities	Nothing precludes an operator from supplying more information at an earlier point in the timeline.
11.3	FF-ICE	3.5.3 Tactical Operational Planning	Near to the actual departure time of the flight (usually 24 hours preceding the flight), information necessary for more precise planning becomes available. This includes winds, weather, system outages, availability of trained crew, and equipment status. The airspace user provides a 4D trajectory representing the desired flight path (appendix D explains the trajectory in more detail). Additional information on aircraft performance capabilities is provided in areas such as navigation, surveillance, communication, separation assurance, safety-net, noise, emission, and wake.
11.3	FF-ICE	4.1 Overview	New mechanisms for flight data exchange will be required to meet future requirements, for example: · Increased amounts of flight information and its wider sharing (more flights, more information about each, better and more often updated, and greater availability to interested parties) · Increased numbers of involved information providers, collaborators, and users · Increased collaboration between airspace users and service providers · Increased services supporting information accessibility and user collaboration · Timely access to relevant information · Increased levels of service supported by new automation capabilities on the ground and in the air · Increased technical quality of service including areas of security, reliability, and latency · Improved interoperability · Improved data consistency and availability for system performance evaluation · Support of the defined and agreed quality of service around the data · Increased fulfillment of the identified ATM service expectations (ICAO Document 9854, Appendix D) · Increased support for layered information security
11.3	FF-ICE	App B.1 Transition Steps - Step 5	Some ASPs who wish to make use of early submission of FF-ICE information may develop a shared forecast service based on information provided in the early submissions.
11.3	9854	2.9 Information Services - Temporality and Issuance	2.9.14 In order to satisfy the requirements of all information users and to avoid waste of resources and the risk of information overload, information management will use a variety of information issuance concepts in relation to the application using it and the media used to carry it. Typically, the information relevant to a flight will be tailored and filtered, and accessible dynamically as the flight is planned and then progresses. Intelligent information management will be used to realize virtually “unlimited” access to information with “limited” bandwidth, and optimize the transfer of information.
11.3	Eng Needs	2.11 Data Exchange System and Network Management	2.11.2.1 Identify flight data exchange throughput requirements, and ensure they are met
11.3	FO ConOps	Section 2.4	In the end state, the FO provides a globally consistent mechanism and consistent interface for the provision and receipt of FO information.

Shall #	Ref Source	Ref Section	Shall Statement/Supporting Source Citations
11.4			**FO shall enable and support system resilience to service disruption and its associated temporary loss of capacity.**
11.4	FF-ICE	4.4 Infrastructure	The infrastructure of the FF-ICE needs to provide interoperability mechanisms at a lower level than the FF-ICE application. This includes also infrastructure services for: Security – Security services must be provided to ensure such aspects as identification, authentication, authorization, integrity, and confidentiality. Reliability – The infrastructure must ensure a known level of reliability. For instance, delivery of messages should be assured with specification on delays and multiple deliveries. Auditing – The infrastructure should support logging information flows to support troubleshooting and to enable issuance of responsibility for user-initiated faults. Service Management – Delivery of services requires the ability to maintain and provide information regarding the services themselves. This can include service registration, discovery, and version control. Version control may include translation services to ensure backward compatibility.
11.4	9854	Appendix D Expectations - Capacity	The ATM system must be resilient to service disruption and the resulting temporary loss of capacity.
11.4	Eng Needs	2.11 Data Exchange System and Network Management	2.11.2.2 Identify types of potential system failure, and establish ways to mitigate them

Appendix B

Requirement 2.1.1 addresses the need to define data elements that support the Concept Components and the Flight Life Cycle Phases detailed in ICAO 9854 and FF-ICE. The citations listed in this appendix provide data element-specific guidance and suggestions from ICAO 9854, FF-ICE, and the FO CONOPS that should be considered when addressing this FO data element definition requirement.

	Guidance Citation
FF-ICE Section	
App A	Table A-2.1 Flight Identifying Information
App A	Table A-2.2 Flight SAR Information
App A	Table A-2.3 Flight Permission Information
App A	Table A-2.4 Flight Preferences & Constraints Information
App A	Table A-2.5 Additional Information
App A	Table A-2.6.1 Trajectory Type

	Guidance Citation
FF-ICE Section	
App A	Table A-2.6.2 Surface Segment Type
App A	Table A-2.6.3 Airborne Element Type
App A	Table A-2.6.4 Performance Information
App A	Table A-2.6.4 Aircraft Intent Type
App A	Table A-2.6 Flight Trajectory Information
App A	Note 1 – Aircraft Capabilities and Flight Crew Qualifications
App A	Note 2 – Flight Status Information
CONOPS Section	
3.	FO Elements